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Vol. IX. NEW YORK, JAN. 22, 1887. No. 4.

REPORTS from England continue to confirm the statements of activity there in the storage field. The number of secondary batteries now going into use is steadily large and increasing.

WE regret to note the death of General Hazen, Chief of the Signal Service. He was an able man, but his "magnetism" was of a negative character. It is said that Captain Greely may be his successor. Perhaps the service will come more directly under civilian control.

IT is now proposed to give the New York Department of Public Works charge of the electrical subways, when the term of the Subway Commissioners expires this year. That is a sensible course, though it might be better for some reasons to continue the Commission. The Public Works Commission has too much to look after already.

BRIGHT and busy Los Angeles, Cal.,—well worthy of its name—was the first city in the Union, it is said, to do away wholly with gas for public lighting and to depend on electric lights. It is now the first place west of the Rockies to put in operation an electric street railway, having started one on the Daft system this month. Los Angeles has our compliments and best wishes.

THE great storm in England, which blew down all the telegraph wires in the country, south of Birmingham, has naturally led to an outcry for a wholesale undergrounding of the wires. But there are obvious objections, and when at the very beginning John Bull finds that an underground system simply between the larger centres of population would cost him $15,000,000, he hesitates. The telegraph department may be doing fairly well, but it could not stand any such burden as that. Probably, the work will be carried about as far as it can reasonably go, electrical and financial questions duly considered.

IN his review on another page of the new book "The Electric Motor and Its Applications," Mr. Carl Hering points to the need that has been felt for some such work, and his remarks are confirmed by the great demand that has shown itself, exhausting the supply just as fast as the copies can be got from the binder's hands. As Mr. Hering says, the data on the subject has hitherto, if published at all, been found almost exclusively in periodicals or reports, and it may be here stated that it was an experience of this fact, in connection with their own work, that caused the authors of the book to set about writing it and compiling for it. Mr. Hering makes, it will be seen, some apt and suggestive comments on motor principles and the course of motor invention.

AT the last meeting of the American Association for the Advancement of Science, held at Buffalo, Prof. T. C. Mendenhall read an interesting account of the action observed in resistance coils, in that they continued to give out a current of their own after the external source of current had been removed. It was suggested later that the heat generated at the junction of the coil proper with the mountings of different metals might give rise to thermo-electric currents, and experiments made seemed to confirm this. Now, however, Prof. B. F. Thomas brings out the results of experiments which would indicate that bad insulation and moisture can be made to account for the phenomenon observed. They go to demonstrate that the true cause of the action observed is to be looked for in electrolytic polarization, more specifically the electrolysis of the water absorbed from the air by the cotton insulation. Perfectly dry coils proved to give no trace of the action, and hence unparaffined coils as ordinarily used are probably unsuited to very accurate work.

ALTHOUGH the construction of dynamos has approached very closely the perfection of theoretical performance, it would be hazardous to say that their mechanical construction has reached such a stage that improvement cannot be looked for. It is true that even now several standard types of machines are in existence, but investigators are continually striving to obtain a greater output for the material employed, or, in other words, to decrease the weight of machines for a given power. This has been attempted in a variety of ways, of which our pages have given ample illustration in the past, but suggestions are still in order, and among them those embodied in the article by Mr. H. F. Watts, which appears elsewhere, are worthy of attention. According to that gentleman, the size and position of the pole piece has a not unimportant influence upon the performance of a machine, and he seems to take the ground that a pole piece is a somewhat undesireable addition to the field magnets of a dynamo. In proof of that he cites an experiment. Turning to the theory applied by him, that the rate of magnetic change determines the output of a dynamo, it would appear that multipolar machines ought to give the larger output per length of wire on the armature. Whether this be so or not it cannot be denied that the latter form of machine is more and more coming into prominence, especially abroad, where several of that type have recently made their appearance.

THE progress which has been made in electric motor construction is well illustrated in the greatly increased efficiency which can now be counted upon in these machines. Only a few years ago 40 or 50 per cent. of the electrical energy absorbed was returnable in the best motors, but to-day 85 and 90 per cent. are obtainable. It shows that the motor has gone through very much the same process of evolution as the dynamo. The latter, having been the subject of particular study in its adaptation to electric lighting, was naturally the first to be developed; but as the dynamo has now reached what may be considered its probable ultimate stage of improvement, so far as efficiency is concerned, the motor is, in turn, receiving its proper share of attention. Despite the results of practical experience which can be drawn upon, the discussion of the proper construction of motors continues. Profs. Ayrton and Perry still cling to their original theory that in the motor the relative magnetic strengths of the armature and the inducing magnets should be reversed; while others are firm in their belief that no radical difference ought to exist between these parts in motor and dynamo, provided disturbing influences are removed. The ultimate decision regarding this conflict of opinion can only be arrived at from the new experience gained by time. Certain it is that direct experiments of Hopkinson, Mordey and others have proven that identically constructed machines have shown almost equal efficiencies as motor and as dynamo.

THE hard lot of the poor, plodding telegraph operator has excited the commiseration of more than one inventor. They have all sought to relieve him of the terrible strain of receiving by sound. The latest of these philanthropists has, it seems, gone even farther than his predecessors, and has obviated the tickling sensation of the touch-sounder by giving the operator something to chew on, as it were, during the operation of receiving. We might suggest that the operator will find his task a dry one, and that a side appendage in the mouth-piece in the shape of a tube connected with a bottle of milk or other invigorating beverage might aid in reading the message more distinctly, as the dry palate is said to be a poor conductor. What an exhilarating spectacle it will be to see the 600 operators in the Western Union building sucking in their messages, when this invention comes into general use! Truly great things are in store for us. This new method of receiving is on a par with that of a Louisville mechanic who thinks he has invented an apparatus which will discourage the giving of false alarms of fire. His appliance is a pair of magnetic nippers, which grasp by the wrist the man who turns in the alarm, and hold him at the box until the arrival of the fire department. The man who turns in the alarm can be released only by the firemen, who are supplied with keys which turn off the current, when the magnet relaxes its grip. What would this country be without its inventors?

IT is now understood that the Third Avenue road in this city will equip with a cable system, in keeping with its cable sections on 125th street and on Tenth avenue. We are not greatly surprised, though we had hoped that in view of the manifest superiority of electricity, some electric motors would be put on that line. The public is now informed by the company that "with some reluctance it abandoned all idea of electricity on account of its expense in the present stage of manufacture and control," and then with a light heart the company votes to put in a system that will cost it from 25 to 50 per cent. more than the costliest electrical system known. It is difficult to understand such procedure, but it is partly explainable by the fact that cable interests are already strong in the road, and by the other extraordinary fact that because the 10 h. p. electric motors will develop, when required, up to 25 horse power, it was declared necessary by the road's present advisers to provide each with steam power on the larger basis of calculation. As a car in its usual work does not take over three horse-power, the outrageous absurdity of the proposition is plain to any one conversant with the subject. However, the electric motor is here to stay, while the cable is not. Besides, not all companies have the leanings of the Third avenue road. One of the leading projectors of the new West End railway to be put down in Boston said only this week: "We proposed originally to use the cable as a motive power, but electricity has *such undeniable superiority* that we have now fully determined to adopt it." It is interesting to note that the West End road may very possibly be run by storage batteries, which would have a favorable opportunity on the line in question.

THE production of aluminum in commercial quantities, which has for so many years occupied the attention of the chemist and metallurgist, has now been transferred to the care of the electrician, and the results thus far obtained seem to indicate that the cheap production for many purposes in the form of alloys is already an accomplished fact. Prof. Vander Weyde's paper, given last week, reviews the attempts made in the past to bring about the desired result, and mentions the fact that aluminum bronze is one of the principal products of the present method devised by the Messrs. Cowles. It is true that the demand for this metal alone far exceeds the present facilities for its manufacture; but there is another alloy not mentioned by Dr. Vander Weyde, which appears to give promise of still greater usefulness, and that is aluminum iron. Recent experiments have shown that a small addition of aluminum to the iron in the puddling furnace converts it into a highly liquid mass, which can be readily poured and cast in any shape, yielding practically wrought-iron castings. The aluminum is added to the puddled mass in the shape of aluminum iron, rich in aluminum, which is obtained in the electric furnace. A small quantity of this alloy thrown into the mass of puddled iron is rapidly melted and gives to the metal the small percentage of aluminum required. The far-reaching importance of this alloy must be manifest to all, as it means a change in the mode of iron working as carried on at present. If, as is stated, this shall prove to be a success, many operations which now require expensive forging work can be performed better and more cheaply in the foundry, while the rolling-mill itself may find considerable of its occupation gone. We hear that several prominent iron and steel manufacturers in this country are now making experiments in this direction, and the results obtained give promise of a great future for the new method of manufacture.

NEW BOOKS.

THE ELECTRIC MOTOR AND ITS APPLICATIONS. By Thomas Commerford Martin and Joseph Wetzler. With 200 illustrations. New York: W. J. Johnston, 1887. 216 pp., 12x9 in. Price, $3.

The rapidly increasing number of electricians and others interested in the subject of electricity will be gratified to see this valuable addition to the literature on the subject of electric motors. Although of such great importance at the present time, there are, strange to say, very few books of any magnitude on this subject. The most reliable and most useful information regarding electric motors and the transmission of power is undoubtedly that obtained from the experiments of scientists and of corporations, and especially that obtained from actual experience in practice. Such data is unquestionably of much greater use to electrical engineers than volumes of abstruse theories on the subject. Unfortunately, however, such information, if published at all, is found almost exclusively in periodicals or reports, where it is frequently overlooked by readers, and where it is often very awkward to find in future references. The authors of this book have therefore supplied a long-felt want by availing themselves of the excellent opportunity afforded to them as editors of THE ELECTRICAL WORLD to rewrite, compile and arrange in a convenient form this large collection of useful and interesting data, including the results of many experiments, and adding to it numerous discussions and explanations of the principles and laws of motors, transmission of power, and other allied subjects, which are stated so clearly that they may be easily understood.

Besides containing a large amount of useful classified data which will be greatly appreciated by all those engaged in this branch of electrical engineering, the book also includes much that is of general interest. It is illustrated throughout with an exceptionally large amount of well selected and well executed illustrations, both of general views and of detailed parts, which aid materially in following the descriptions. It is apparently quite up to date, and as a compilation it is one such as only the editors of an enterprising journal can make.

Chapter I. contains a few preliminary remarks regarding the evolution of the motor, Barlow's wheel being mentioned as the first motor, while the practical motor, it is said, dates back only to 1873, when the reversibility of the dynamo was first fully realized. It is shown that the action of the motors of to-day is primarily that between a magnet and a wire conveying a current, as distinguished from the older motors, in which it was chiefly the action between magnets. I am pleased to see this principle fully recognized, as many inventors have been led in the wrong direction by the supposed fact that a more efficient motor can be made by utilizing the powerful pull of magnets than by the apparently small force existing between a magnet and a wire conveying a current.

The nature of the counter electromotive force of motors is explained briefly but very clearly. It is shown that this is not an objectionable feature of motors; on the contrary, that upon this its true value as a working and useful machine depends. The statements so frequently misunderstood, even at the present time, regarding the difference between the conditions of maximum efficiency and those of maximum work or activity, are clearly explained by obvious examples and without any abstruse mathematics; also that the efficiency is indicated by the ratio of the two electromotive forces, and that, therefore, a motor should never be worked to its fullest capacity when efficiency is desired. A very good analogy is given to a similar relation in the steam engine. This is followed by some general principles regarding the best proportions of motors, showing by a series of analogies that they are the same as those for the best dynamos, a principle which has been disputed, but which we think is now fully recognized. A clear explanation, well worth the close attention of designers of motors, is given regarding the lower efficiency of a dynamo when it is used as a motor.

In Chapter II. is given an early history of the development of motors in Europe, dating from Barlow's wheel, and containing a number of illustrations with interesting descriptions.

In Chapter III. is supplied what has long been necessary, a history of early motors in America. It is greatly to the credit of the authors that they have given this subject their special attention, as it has, strange to say, been generally omitted in previous works on motors. It is unquestionably the most complete collection to be found outside of the cumbersome records of our Patent-Office, and will, no doubt, create some surprise among our European cousins. In it is shown that about the same time that Jacobi was using motors for propelling a boat in Russia, an American was using them for printing and for electrical railroads. This very interesting chapter is accompanied by quite a large number of appropriate illustrations.

Chapter IV. treats of the electrical transmission of power, beginning with an account of its discovery in 1873 at Vienna. It appears, however, from Chapter II. that the Americans should have the credit of its discovery, as it was patented here as early as 1840 by Pinkus, who stated that "stationary mechanical generators," instead of batteries, would be used for electrical railroads, with the rails as conductors.

The algebraic and graphical discussion of the fundamental principles of the transmission of power, illustrated with examples, is very intelligently stated; in it the often misunderstood statements regarding the conditions of maximum efficiency and those of the maximum work are clearly explained, and are given the prominence which their importance demands. This is followed by a discussion of the relations which the various quantities bear to each other, including the statement of Deprez, that the efficiency is independent of the distance of transmission, which, by the way, is true in theory, but not in practice, owing to the limitation of potential.

It will be discouraging to Americans to hear that a Frenchman was the first to propose, in 1882, to use a larger wire in order to decrease the resistance. The illustrated descriptions of Deprez's experiments contain interesting and instructive data. The chapter concludes with a detailed discussion of the heating of wire conductors and of their most economical cross section.

The detailed descriptions in Chapter V., of Electrical Railroads in Europe, accompanied by interesting and useful data concerning actual expenses, repairs, etc., are well worth the attention of engineers and capitalists, as they show what has actually been done as distinguished from what might be done according to theoretical deductions. The descriptions are accompanied by numerous illustrations of detailed parts and general views, which, together with the detailed dimensions, electrical measurements, etc., will serve well as a reliable guide for constructors.

Chapter VI. contains similar details and richly illustrated descriptions of American electrical railroads, beginning with the interfering claims of Edison and Field in our Patent Office, which were decided in favor of Field, though it does not appear how Field could be allowed such broad claims in view of the patent of Pinkus in 1840, mentioned in Chapter III. It appears from this chapter that the subject of electrical railroads has received more attention in America than is generally supposed.

In Chapter VII. the subject of the use of storage batteries for electrical railroads is given the prominence which it well deserves. In comparing this system with the others, it is stated that it is a question of a greater cost of power, as compared to a larger original outlay of capital. The detailed illustrations, descriptions, and the data given are both interesting and useful. Chapters VIII. and IX. on the industrial application of motors in Europe and in America, contain illustrations and descriptions of the later motors and their applications. The next chapter includes some interesting matter on the application to marine and aërial navigation, and to telpherage systems.

The last chapter treats at some length of the latest American motors and motor systems, the greater portion being devoted to the Sprague motor and system, and to a somewhat elaborate theoretical discussion of the motor. Numerous useful and important statements are made regarding the action and requirements of series, shunt, constant potential, constant current, and constant speed motors. Sprague is credited with first making the obvious, though at first seemingly paradoxical statement, that with a motor on a constant potential circuit, the field intensity must be decreased for an increase in the mechanical effect.

The two appendices are interesting papers on the operation of motors from central stations, by Mr. Martin, and on the Julien accumulators and traction system, reprinted from THE ELECTRICAL WORLD. CARL HERING.

THE PATENT LAWS OF ALL NATIONS. Compiled and annotated by Benjamin Vaughan Abbott. Washington. Charles R. Brodix, Law Publisher, 1886. Vol. I. Algeria-Turkey, 580 pp. Vol. II. United States—Wurtemberg. 634 pp. Law size, 9½ by 6 inches. Price, $6.50 per volume.

Under the above title have been published the first two volumes of a work which is to include, besides the patent laws of all nations, the court decisions which interpret the British and American laws. The volumes which have already appeared contain the statutes of all the countries whose patent laws have appeared in the English language. The scope of the present volumes, except as regards the United States laws, is substantially the same as that of the work published by Messrs. Carpmael about two years ago. The patent laws of the United States, however, are treated with far greater exhaustiveness than by the Carpmaels, and the laws and the editor's comments thereon occupy nearly the whole of the second volume. The notes on this part of the work are original, and are understood to have been freshly written up from a recent comparison of the sources.

Of course nothing can be said at this time regarding the "patent cases" which are to follow, except as the work already done gives promise of what can be expected. The plan, however, of compiling into a single series of volumes all the patent cases ever passed upon in Great Britain or America is every way to be commended, and will be appreciated by those who have had to purchase a series of different libraries in order to make their list of patent cases complete. Another point in favor of the plan is that the series will be annotated by one person, so that there will be opportunity for side references throughout the whole series, to say nothing of the advantage of having complete uniformity in the mode of treatment.

Of the volumes already given to the public, the first is probably the least valuable of the entire series. Not that it is not essential to a patent library, but that the same work had been done before in substantially the same way. The same cannot be said, however, of the work contained in the second volume. Mr. Abbott's notes on the United States Patent Law are unquestionably valuable, and valuable to an unusual degree. In fact, the quality of his work in this volume is in danger of making the rest of the series unnecessary, if that were possible. For example, one might get a very good idea of the present status of the Reissue question by consulting the matter on pages 197 to 205 without going to the full text of the decisions in the cases. The editor has used excellent discrimination in making his digest and selecting his citations so as to bring out the important features of the subject. Without giving in detail special samples of Mr. Abbott's work, reference may be made to page 108 et seq., where the subject of Licenses is treated, and to page 352 and the following pages, which relate to the Measure of Damages. Mr. Abbott has brought to his work a discriminating judgment which gives it a special importance.

It is to be regretted that the editor confined himself to the publication of such laws only as he found "in English dress," and still more that he did not revise the translations which he made use of. His familiarity with the terminology of the Patent Law would have enabled him to correct many obvious errors in the current English versions of foreign laws. To correct some of them, he would not have needed any special qualifications. In reading "The invention shall be designated by the summary and truthful title which the demander shall have indicated," one need not be a profound student of patent law to know that the translator has given us a foreign idiom, and a faulty—not to say unintelligible—English sentence. "All cessions and mutations, total or partial, of a patent shall be notified to the department of the interior." This is not good English, whatever kind of patent law it may be. These slips occur (pages 48 and 50) in a translation the whole of which abounds in verbal infelicities and inaccuracies. The rendering is copied from the *Patent Office Gazette*, whose translations of foreign patent laws are notoriously bad. The translations of the Carpmaels are much better, and, where there is a choice, their version has usually been taken, but these might also be improved upon. It is to be hoped that future editions will contain carefully revised translations in place of those now published.

ALUMINUM: ITS HISTORY, OCCURRENCE, PROPERTIES, METALLURGY AND APPLICATIONS, INCLUDING ITS ALLOYS. By Joseph W. Richards, A. C. Philadelphia: Henry Carey Baird & Co. 1887. 346 pp., 5½×8 in. Price, $2.50.

Barring that of iron, the metallurgy of no one metal has received more attention recently than that of aluminum, but the works specially treating of it are mostly in foreign languages and are not brought down to date. Hence the appearance of the present volume is undoubtedly timely, and worthy of attention by those interested in the production of aluminum and its alloys. The title of the book explains fully the lines upon which the author has worked. He has explored thoroughly the field of information on the subject, to which he has added the results of his own experiments. The electrical part of the subject has by no means been neglected, and a full description of the Cowles process of obtaining aluminum alloys is given, so that not only the chemist and metallurgist, but the electrician also, will find much to interest him in a work which affords excellent means of comparing the different methods of production. The book is well printed, and illustrated by a number of engravings. We might here ask some one in authority to determine once for all whether it is "aluminium" or "aluminum." We are not asking for dictionary warrant, but for a spelling that all will accept. Which is it to be?

Settle's Electric Mining Lamp.

Mr. Miles Settle, a well-known English mining engineer, has devoted much time, money and labor to the development of both stationary and portable lamps for mines, and, as the outcome of his efforts, he has introduced a lamp which appears, says *Industries*, to answer the requirements of a satisfactory fixed light, whilst at the same time making considerable progress towards the production of a portable safety lamp. The former of these consists of an incandescent lamp suspended in a thick glass of tumbler shape, beyond which is an outer glass of similar form and constitution. Between the two glasses is a space of about 1¼ inch, filled in with water, or, if preferred, carbonic acid gas or any fluid exerting pressure. Above the incandescent lamp a metal float is so arranged as to be governed by the pressure of the water below, any addition to the water causing the float to rise, and any abstraction of water making it fall. The water is regulated by means of small taps. The float acts as a switch, the raising of which, in the manner indicated above, connects the electric circuit and effects the lighting of the lamp; its fall disconnects the circuit, and causes the light to go out. An important feature of the lamp is the extreme sensitiveness of the float, the addition or abstraction of a very small quantity of water sufficing to make it operate. The current is generated by a dynamo, situated above or below ground, capable of lighting 40 incandescent lamps, and worked by a small engine running at high velocity. It is conveyed to the lamps by means of heavily insulated wires, which are connected in such a way as to fall in

with the workings of the float already described. Each lamp gives a bright and steady light of 32 c. p. visible for a distance of more than a quarter of a mile. The lamp has also passed satisfactorily through most exhaustive and crucial experiments made to substantiate its claim to perfect safety. The working lamp is constructed on much the same principles. Safety is its leading characteristic, and, owing to the action of a spring catch, the lamp, if once extinguished, can only be rendered serviceable by being opened with a key, which would remain in the possession of responsible officials. With regard to its portability, however, the fact of its depending for the electric current upon insulated wires conducted from the dynamo, is a drawback which must militate against its general adoption, and which, perhaps, outweighs the advantages derivable from its lightness, the weight being only 1¼ lbs.

Some Electrolytic Preparations of Metals.

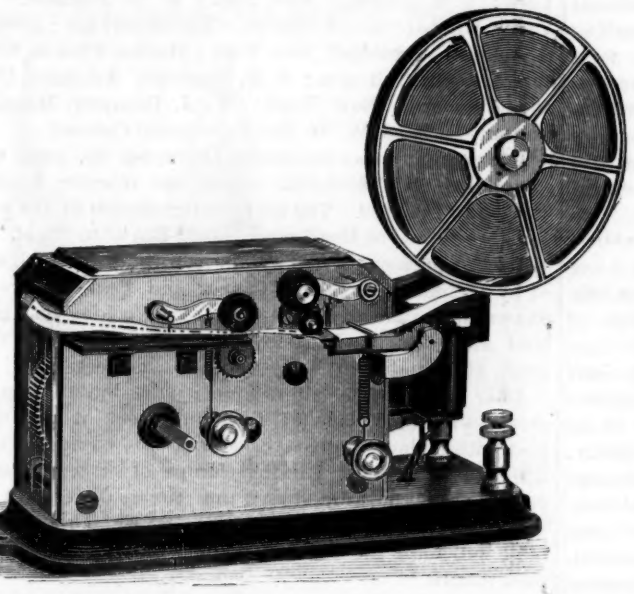
George Leuchs, of Nüremberg, has recently patented, in France, a new method for obtaining copper, zinc, lead and silver in a metallic state by electrolyzing the fluosilicates and fluoborates of these metals. In the usual method for obtaining copper in large quantities electrolytically, it is necessary that the deposition should take place slowly, and that the electrodes should have a large area, otherwise the metal is not deposited in a dense and compact condition. If a solution of the fluoborate or fluosilicate of copper be used as the electrolyte, then the electrode may be a small one, and the copper will be deposited in a denser condition than by the ordinary process. Zinc is only separated with difficulty by electrolysis of its alkaline solutions; but, with the fluoborate and fluosilicate, a brilliant and compact deposit of metallic zinc is obtained without any difficulty. Lead has never been obtained in a coherent state by the electrolysis of either its nitrate or acetate: but when the fluoborate or fluosilicate is employed, a good deposit, both bright and coherent, is obtained. If the positive electrode is made of a substance which is not attacked by the oxygen evolved, then a compact deposit of lead peroxide is simultaneously produced, so that, on disconnecting the battery, we have a simple form of accumulator which will return to its original condition when the stored electrical energy has been allowed to run down by connecting the two electrodes by a wire. The author of this method recommends, in this latter case, electrodes of natural charcoal, or of charcoal caked together with or without kaolin. The surface of the negative electrode should be smooth, while the one on which the peroxide of lead forms should be rough. Free acid in the solution has no injurious effect on the deposition, except in the case of zinc, when the electrolysis proceeds best in neutral solutions. In another recent patent, by M. Eug. Marchese, lead and argentiferous copper minerals are treated electrolytically, by using for the anode the metallic sulphides which the process is required to reduce. As sulphide of iron is usually associated with these minerals, the heat of formation of sulphate of iron in the solution increases the amount of E. M. F. available for the reduction. The solution obtained by lixiviating the wasted minerals with sulphuric acid forms the electrolyte, and is made to continually circulate from the vessel in which the lixiviation is conducted to the vessels used for the electrolysis. This circulation of the liquid is said to diminish very considerably the polarization of the plates. A plate of copper, formed by electrolytic deposition, forms the cathode. In practice, a row of from fifteen to twenty anodes is used in each cell, a cathode of copper being placed between each.

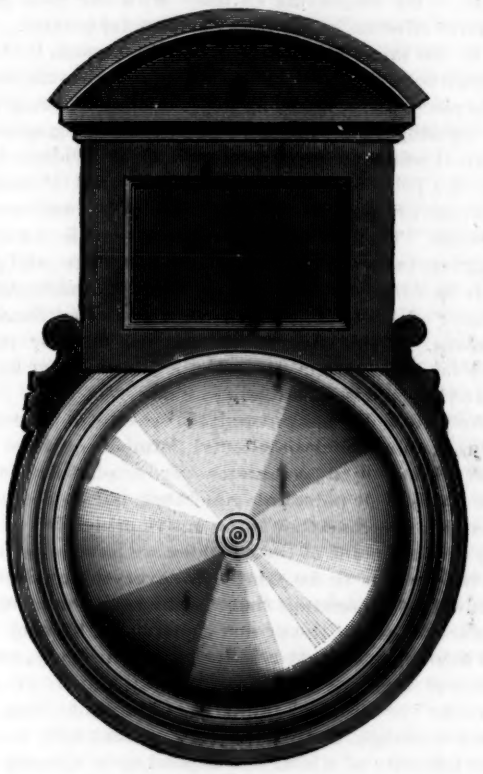
Mr. Edmunds' Postal Telegraph Bill.—Mr. Edmunds, in the U. S. Senate on Jan. 17, called attention to a bill introduced by him and referred to the Post-Office Committee, providing for a government postal telegraph. He wished the committee to report either favorably or unfavorably, so that he might try to get the judgment of the Senate upon it.

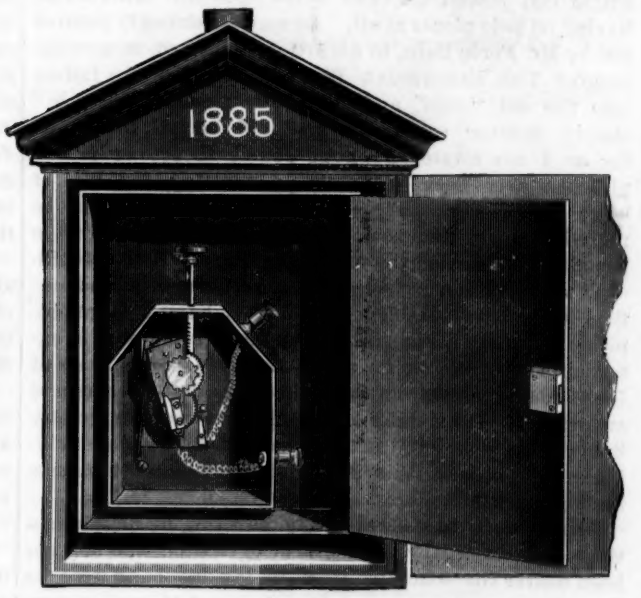
A New Fire Alarm System.

Many of the smaller towns in this country still summon aid in case of fire by means of alarm bells, but the great superiority of the fire telegraph is rapidly bringing it to the front as a substitute for the older method. A recent fire telegraph system, which merits attention on account of its simplicity, is that of the Union Fire Alarm Company, of this city, which is well adapted to small cities.

FIG. 3.—NEW FIRE ALARM SYSTEM—VISUAL INDICATOR.







FIGS. 1, 2 AND 4.—A NEW FIRE ALARM SYSTEM.

The system employed by the company, which we have seen in operation, is an open circuit one, requiring only one wire; but it can readily be changed to a closed circuit without any additional expense, except that of the extra wire. The street box employed is shown in Fig. 1. It contains the call box which sends in the signals when the vertical rod shown is depressed, and, as will be seen, is amply large enough for the placing of ambulance and police calls.

FIG. 5.—NEW FIRE ALARM SYSTEM—MESSENGER CALL BOX.

The signals sent in from the street boxes are received on three different apparatus, one of which sounds an audible signal, as a gong, shown in Fig. 2, which notifies the firemen all over the engine house. Next, the signals passing into an indicator, shown in Fig. 3, cause the number of the box to be exposed. The apparatus by which this is accomplished is a most ingenious one. And, finally, the signals are recorded on the new register, shown in Fig. 4, so that a permanent record is obtained. Besides these, the system comprises repeaters, tower-bell strikers, etc., and all the devices that go to make up a complete system.

The signal box employed, which is shown detached in Fig. 5, is equally well adapted to the district messenger service, and the latter can be made to embrace also fire, police and ambulance calls.

Polarization of Resistance Coils.

In a communication on this subject to *Science*, Prof. Benj. F. Thomas, of Columbus, O, gives some interesting details regarding the origin and probable cause of the phenomenon:

In August last Professor Mendenhall, in conversation with the writer, alluded to his observation of the polarization of certain resistance coils, and suggested an examination of the coils in this laboratory. The examination was made, and the results stated in remarks upon Professor Mendenhall's paper at the Buffalo meeting of the American association. A brief account may not be without interest and value.

The idea entertained by Professor Mendenhall at the time seemed to be that the polarization was of a "statical" nature; the deflection obtained on connecting the coil, through which a current had been passed, with a galvanometer, being produced by the "residual charge." The examination of our coils was undertaken with the same idea, the "condenser discharge" method being made use of, substituting the coil under trial for the condenser. The galvanometer was a 6,000 ohm astatic Thomson, by Elliott Brothers, its needle making a vibration in about ten seconds. A Fuller cell and Sabine discharge key were used. Polarization was found in every coil in the laboratory, except in a standard B. A. unit from Elliott Brothers. It was also found in a Hartmann box loaned for examination by Messrs. Queen & Co. The effect was found to vary widely in different coils in the same box, particularly so in a box of 100,000 units from Elliott's, whose 40,000 coil gave 40 degrees deflection against 6 or 7 degrees for any other coil in the box. On opening the box, it was found that the 40,000 coil had been heated till the paraffine had melted and some of it had run off, while the other coils were well covered, as usual in Elliott coils. The Hartmann box, whose coils were not paraffined, showed the effect more strongly than any except the 40,000 Elliott. It was observed that the coil terminal connected to the positive pole of the battery in charging, was itself positive in discharging; that reversing the battery reversed the discharge deflection; that the deflection was not momentary, as with condensers, but that it indicated a steady current, diminishing slowly, but not ceasing in some instances after eight or ten hours; that when the coil was charged by battery for several minutes, and then the current reversed and allowed to flow a few minutes longer, the discharge current was at first due to the last charging current, but after a time it ceased, and was followed by another discharge current due to the first charging. An experimental coil was then made up of 1,800 ohms of wire having unparaffined cotton insulation. It was wound on a warm rainy day, and tested immediately, showing the strongest polarization found, driving the spot of light violently off the scale. The coil was then baked in a hot-air oven at 150 degrees C. for an hour, and tested again when cool. No trace of polarization could then be found, though the charging current was increased. The previous observations of course indicated electrolytic polarization as the disturbing cause; and the last showed, that, in the case of that coil, it was the electrolysis of water absorbed from the air by the cotton insulation. The experimental coil was then heated, and soaked well with pure paraffine, and drained while hot until it seemed to be as nearly as possibly in the same condition as the 40,000 Elliott coil, and tested when cool. No trace of polarization was shown. It was then put aside in the instrument case to see whether it could still absorb water enough to polarize. Ten days later, just after the Buffalo meeting, the coil was tested

again and polarized strongly. On heating it again, the polarization entirely disappeared. A drop of hydrant water placed on the coil caused polarization to re-appear in five seconds, and in five minutes the effect was so strong as to drive the needle to its stops.

The degree of error in measurement resulting from polarization was not examined, but Professor Mendenhall's statements show that it may be a considerable quantity.

It is obvious that unparaffined coils are, on this account, unsuited to the best work; also that coils well paraffined (as in the B.A. unit coil) or coils freshly baked and paraffined are free from such error.

The paraffining of ordinary coils, even when as thoroughly done as by the Elliotts, is not a permanent protection, probably because of cracking of the mass of paraffine, allowing vapor to reach the wire and insulation. A test will quickly determine the condition of any particular coil. A box might be made proof against polarization by filling entirely the space about the freshly baked coils with pure paraffine, just warm enough to flow freely. Temperature difficulties could be in part overcome by thermo-junctions, as in standards. Another and on some accounts better plan would be to mount the coils in an impervious box, with liquid-tight joints, and filling the interior with a petroleum oil, which may readily be found in market, of such quality as to exhibit no polarization. With such a box, there need be no uncertainty as to the temperature of the coils.

Pole Pieces and Dynamo Construction.

BY H. F. WATTS.

It is quite noticeable that by far a large majority of the dynamo machines in use at the present time are of the "consequent pole" type and having large pole pieces. Other forms of field magnets are used to a limited extent, in which the pole pieces are small and are energized by a single coil placed above or below, and still other forms having no pole pieces at all. As was so strongly pointed out by Mr. Forée Bain, in his article published in a recent issue of THE ELECTRICAL WORLD, inventors are falling into the old "ruts" and using the "consequent pole" simply because some one else did before them. As far as I am aware, no good sound theory or principle has ever been set forth advocating the use of large pole pieces; and their advantages appear to be more imaginary than real. It is true that they are often beneficial, increasing the mechanical strength and stability of the machine; but electrically speaking their advantage is very questionable. In dynamos having large pole pieces there can always be observed a large amount of external magnetism on or about the pole pieces, lines of force that leak out from the projections and corners and are wasted. These lines of magnetic force are greatly liable to magnetize the watches carried by persons standing near. Indeed, this is a characteristic of dynamos having large pole pieces.

Any dynamo that is capable of affecting by magnetism the watch carried by the engineer in charge, who has not been nearer the machine than to lay his hand upon its bearings, gives a sure proof that it is not of good proportion (in the matter of masses of iron), and that the lines of force are not concentrated upon the armature as they should be. Certain well-known machines of to-day could be mentioned in which this is very marked, but the object of this article is not to deal with dynamos individually, but in general, and to assist in showing in what details improvements can be made. It is extremely difficult to magnetize a large pole piece to saturation; the magnet cores themselves, on which the magnetizing coils are wound, can easily be brought to that state, and when even beyond saturation (supposing such a thing to be possible) the pole pieces are far from it. To magnetize a bar of iron requires a certain amount of energy (ampère-turns); the larger the mass to be magnetized the greater must be the energy necessary to saturate it; in all cases the amount that we can economically spare in producing our field is limited; hence we should not employ so large a polar mass that the magnetizing coils are not capable of saturating it, and having produced our field, it should be utilized *as directly as possible*, and without the intervention of any pole piece.

Suppose we have a straight bar of iron, say one foot long, which is wound with a coil of wire on one-half of its length only; that is to say, it is wound from its centre to one end, leaving the other half bare, so that the bar projects six inches beyond the coil at one end and about one-fourth of an inch at the other. On sending a current into the coil two poles will be set up, one at each end of the bar. At the end nearest the coil the magnetism will be found to be very intense, while at the end most distant (which we will call a pole piece) it is very much weaker, and if this long end of the magnet be lengthened sufficiently it will be found to be neutral, not having magnetism enough to lift iron filings.

This simple experiment may be performed by almost any one, and the relative attractions at the two ends of the bar tested by the force necessary to detach a piece of iron from them, which will be found to vary greatly, as stated above.

If, now, we wish to attract strongly a bar of iron like the armature of an ordinary telegraph sounder, we would naturally place it very near to the short end of the bar, and very near the coils, and not at the end most distant from it, where, as we have seen, it is very weak. Yet, this latter act is just what electricians are doing when they place the armatures of their dynamos under the influence of large pole pieces. It is better to employ a small polar mass which can easily be magnetized to a high degree, than a large bulk which can be but partially and unequally magnetized; for it is well known that the latter is much more sensitive to changes of current in the field, and also to induction and counter magnetism due to current in the armature than is the former.

A certain author has said "the field magnetizing coils should produce as intense a field as possible *in a region where the armature rotates.*" In the case of a large "consequent pole" piece we are producing an intense field at the junction of the field magnet cores proper and the pole pieces, while at that portion of the pole piece that is brought to bear upon the armature or "where the armature rotates" it is relatively weak. In machines with very large pole pieces the current necessary to produce the field (if it is maintained in a state of high magnetization) is a large percentage of the total current in the armature. This alone would render it uneconomical, but added to this is the increased length of wire per volt upon the armature, necessitated by the useful field being too weak to generate the required E. M. F. without increase of speed. This means a higher internal resistance and a more intense armature field, which weakens the field proper and influences largely the position of the brushes, besides other harmful effects. All these and many other wasteful reactions can be traced directly to the deleterious influence of too large a polar mass. By dispensing entirely with the pole piece we remove effectually all these detrimental actions.

On this same point Prof. S. P. Thompson, in his well-known book says that, in his opinion, "these wide embracing pole pieces are responsible for false inductions, giving rise to opposing electromotive forces, and setting up secondary neutral points at the collectors." It is evident that the use of a pole piece is a mistake, and that if mechanical convenience points to its use it should be made as small as possible. The best possible arrangement is for the field magnets to be "end on" to the armature, and *placed so near to it that its core feels the direct and independent influence of field-magnetizing coils as well as the iron they contain.* If this suggestion is carried out the result will be a far more perfect utilization of the current in the field than is otherwise possible.

Another point not recognized by electrical men generally, is, that it is not the total number of lines of force that are cut by the conductor per second that determines the current or potential generated, but it is the *rate of change per second* that is the active principle.

From the point of theory alone we have a perfect right to believe this to be true. In everything electrical we know that it is *change* that produces phenomena. In an induction coil, if the primary current is flowing steadily, no secondary current is induced, for a steady, continuous current has not inductive action; but if we suddenly "make" or "break" the primary circuit, then we prodnce a change, and a secondary current will be induced, the intensity of which will depend upon the *suddenness* of the change (make or break), and its duration upon the time during which the change *lasted.* So, also, in dynamos, the armature may be running in an intense field and cutting lines of force and not generate any current, or, at least, generating a very small current in comparison to the number of lines of force that are actually cut, because the rate of change in a given armature movement is very slight.

The armature enters the field at a very weak point and moves on to a point of greater intensity until a maximum is reached: then the intensity decreases in the same way (gradually).

On referring again to the induction coil, what would be the effect of *gradually* putting current into the primary coil or of making the "makes and breaks" gradual? This is the trouble of a great many dynamo machines of to-day; while the actual strength of field (if it is all brought to bear upon the armature) would suffice to generate double the current the machine is capable of doing as at present constructed, the change brought about in one revolution being insufficient to generate more than its present capacity. In all dynamos, especially those having large pole pieces, the point of maximum induction is situated very near the edge of the pole piece, or pole, showing this to be the most useful point of the field, and also proving that *the greatest current is being generated at that point of the revolution where the rate of change is greatest.* This would show that the use of a pole piece embracing a large portion of the armature is a mistaken construction. Thus, cases are on record in which the "output" of a dynamo has been doubled without any increase of speed by merely doubling the number of poles, and decreasing their size; the total strength of field, or the number of ampère turns in the field was the same in both cases, so that the number of lines of force cut in one revolution was the same as before; the rate of change alone was increased.

In actual practice there are many serious objections to the use of a dynamo with thin poles, the principal one being their great liability to heat badly, in consequence of the rapid reversals of polarity of the armature core, and also the so-called "eddy currents" in the field magnet cores. But, if the writer's recommendations are carried out as above, and the magnets placed "end on" to the armature, there is no reason why they cannot be made up of a bundle of wires of soft annealed iron, each individual wire being thoroughly shellaced and dried before being placed inside the coil. This will, at least, minimize the heating of the magnet cores. The armature core is not so easily dealt with, but if laminated properly will not heat excessively.

Such a machine as this, having no pole pieces, and with the *magnet coils embracing the armature*, would give a nearly constant potential at a uniform speed, and would have a very low internal resistance. The neutral point would remain constant for all changes in current, and would be very sharply defined, so that the brushes can be placed very close to the generating coils, without making contact with them, thereby relieving the armature of the resistance of all the idle coils. In machines as ordinarily constructed the neutral point of the field is not sharp, but is very gradual, so that there is no particular point where the line can be drawn separating the neutral from the useful field, or separating the coils that are generating current from those that are not; and those coils that are very near to the brushes, although generating but very little current, cannot make contact with them without causing great sparking at the brushes.

Multipolar dynamos are coming into use more and more, their high efficiency being directly due to the increased rate of change in one revolution, and also to the fact that, the poles being small, they can easily be maintained.

The Edison Plant in Boston.

The first annual meeting of the Edison Electric Illuminating Company of Boston was held in that city January 5th, 1887. The following board of trustees were elected: T. Jefferson Coolige, Boston; W. Powell Mason, Boston; Jacob C. Rogers, Boston; Richard Rogers, Boston; C. T. Christeinsen, New York; C. H. Coster, New York; F. S. Hastings, New York; E. H. Johnson, New York; Hubbard Breed, Boston. The officers are: Edward H. Johnson, President, New York; Hubbard Breed, Clerk and Treasurer, Boston; F. S. Hastings, Assistant Clerk and Treasurer, New York; W. J. Hammer, Manager, Boston; D. W. & W. W. Gooch, General Counsel.

This company was organized December 26, 1885, with a capital stock of $100,000, which has recently been increased to $250,000. The first district station of the company is situated at Head place, off 23 Boylston street. The district at present served by the central station is bounded by Tremont, Boylston, Carver and Pleasant streets; Shawmut avenue and Indiana place; Washington, Kneeland and Albany, Kingston, Summer, Milk, Arch, Congress, State and Court street to Tremont street.

After some slight alterations in the building on the premises at Head place (off Boylston street), it was occupied with boilers, engines, dynamos, etc., having a capacity of twenty-eight hundred lamps of sixteen candle-power, actual burning at any one time. This plant was started on the 20th day of February, 1886. The following table will show the number of lamps in operation during each month:

Month.	Lamps connected. 16 c. p. basis.	Month.	Lamps connected. 16 c. p. basis.
February	627	August	2,773
March	771	September	3,768
April	1,025	October	4,430
May	1,805	November	4,645
June	2,318	December	4,847
July	2,588		

A new building is now being erected which will be one of the finest central stations in the country. It is entirely built of brick and stone, and fire-proof throughout; with concreted floors. There will be ample room for engines, dynamos and boilers for a maximum capacity of twenty-five thousand lamps, which will enable the company to operate forty thousand lamps throughout their district. The first installment which is being made will give the station a capacity of six thousand lamps at once, and will admit of ten thousand lamps being connected, as not more than sixty per cent. will be in use at any one time.

Since the inception of the station, the company has been extending its system of conductors, which has been an overhead one, and within the last few months has commenced the installation of the Edison three wire underground system, comprising also three flexible Callender feeders, the whole amounting to between five and six miles of conductors, having a capacity of ten thousand lights. More than three-quarters of this work is already completed; and it is expected that by the time the machinery is in operation in the new station, the underground conductors will also be in perfect order. The overhead system will then be taken down.

The company has also made extensive application of its current to the electric transmission of power, and has at the present time about thirty Sprague electric motors, varying from one-half to ten horse-power. This station is in fact the most important electric power station, not only in this country, but in the world; and there is every prospect of a very large increase in this portion of the business within the next few months. The New England agency of the Sprague Motor Company, represented by H. McL. Harding, effects the sale of the motors, after which they are placed under the control of the Edison Company, who supply the power at a specified rate per horse-power, ac-

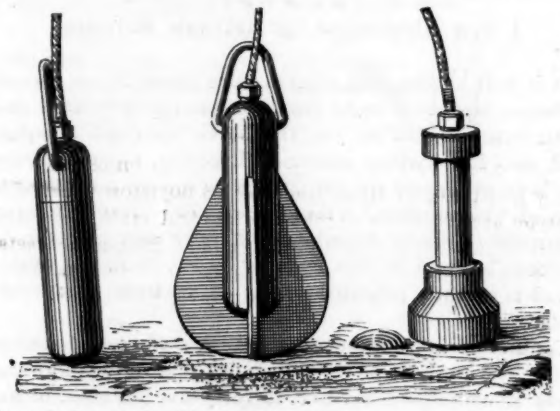
cording to the conditions in each special case. In some cases this is arranged on a contract basis, and in others the current is measured by meter in the same manner as the light.

There will be several features in the new station which have not been used in any Edison station in this country. As soon as this plant is in operation, the engines and dynamos in the old building will be removed and the building transformed into a boiler house. There will be seven boilers installed upon the lower floor and seven on the floor above, and a portion of the space which remains will be arranged for storing fuel; a brick stack for four thousand horse-power will also be erected, which will act in conjunction with the old one of six hundred horse-power. Since the middle of August the control of the station has been in the hands of Mr. W. J. Hammer, manager and electrician of the company, assisted by Mr. E. W. Godfrey, superintendent of construction. Some of the principal consumers are: The Adams House, 450 lights; the Bijou Theatre, 707 lights; the Young Men's Christian Union, 400 lights; Bigelow & Kennard, 200 lights.

Irish's Electric Marine Sounder and Shoal Water Alarm.

BY W. E. IRISH.

This apparatus, as its name implies, is intended for use on board ship for measuring the depth of water. It is designed to take the place of the uncertain and inconvenient lead, over which it possesses several important advantages. In sounding with the lead some labor and skill is required and a considerable amount of time is wasted through having to slow down the speed or stop the vessel while doing so; tides are thus missed, and, in consequence, vessels are frequently prevented for many hours from getting over the bar, or into harbor or dock to discharge or load, and as a result other freights and charters are lost to the owners. The most experienced sailors when taking soundings with the lead are very frequently in doubt as to whether it has fathomed or not, and in some waters it is quite impossible to take a reliable sounding with the lead. Such is not the



FIGS. 1, 2 AND 3.—MARINE SOUNDER AND SHOAL ALARM.

case with the electric sounder, which requires no such careful handling and watching. On being thrown overboard, the latter immediately sinks, and on its reaching ground instantly and automatically closes an electric circuit through an alarm on deck calling attention to the fact, and, at the same time, recording the number of fathoms of cable paid out when the alarm sounded. This apparatus was specially designed for surveying, but is equally as applicable for general navigation, as it enables a commander of a vessel when coasting or sailing in shoal or other waters to obtain reliable observations in the shortest possible time as to the depth or variations in the depth of the water he is navigating; it enables him also to steam or sail in shallow waters at increased speed with safety, where other vessels not so equipped dare not venture to enter. The captain in command of a vessel surveying or hugging a dangerous coast will, by simply trailing continuously the sounder with a few fathoms of line paid out beyond that required to reach below the vessel's keel, whenever the sinker touches ground within the limit of the line allowed, have his attention drawn to the fact by the alarm, which will continue to sound until the vessel moves into deeper water or the line is shortened.

The complete electric marine sounder equipment consists of a sinker or sounder, three patterns of which are illustrated in the accompanying engraving, a line containing an insulated flexible conductor wound on a reel, an indicator and register for registering the length of line paid out, an alarm and an electric battery. The two latter may be placed on the bridge, in the engine room or in any other part of the vessel as found most convenient. The sounder is simply a heavy piece of metal, cylindrical in shape, having a hole about one-eighth inch in diameter bored in its centre to a depth of several inches. A small quantity of mercury is poured into this cavity, partly filling it, and the water-tight cap through which the insulated wire passes, being screwed on, completes it. The end of the wire within the sounder is normally insulated, although exposed within the case, so that while the sinker is held in a vertical or nearly vertical position by the line, the wire end remains insulated; but when it is held horizontally or considerably inclined, as would be the case when dragging or touching bottom, the mercury will flow along the channel until it reaches the exposed end of the insulated wire with which it completes the electrical circuit through the metal of the sinker to ground and sounds the alarm.

The indicator is contained in a metal case exposing a dial marked in figures representing fathoms, and a pointer which is moved forward one step for every fathom of line which passes over the wheel which actuates it. Any ordinary electric bell can be employed to give the alarm, and the battery to operate it may be any one of the very numerous forms employed for similar purposes.

In a vessel employing this apparatus for surveying it would not be necessary to heave the sinker overboard, as is customary when employing the lead, as the sounder would be passed through a pipe secured to the vessel's side

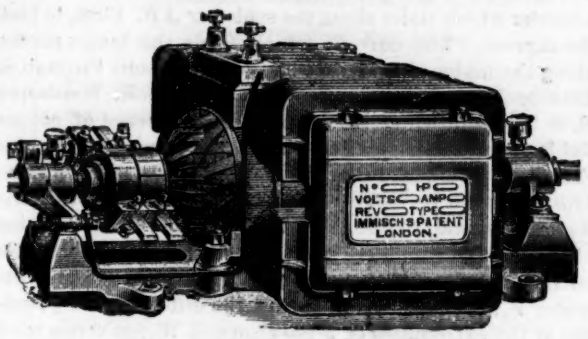


FIG. 1.—THE IMMISCH MOTOR.

and extending below the keel. From the bottom of the pipe, the sounder is released by operating a lever on deck. The advantage of this arrangement is that the drag on the sinker and line is considerably reduced, enabling a much quicker sounding to be obtained, while the vessel may proceed at a very much greater speed than would be possible when fathoming with the lead in the usual manner. Figs. 1 and 2 represent one form of sounder, differing only in outward appearance. That shown in Fig. 3 was designed more for taking soundings from vessels when not in motion. In the latter the line with its insulated conductor passes through the top of the watertight junction, the wire being connected to an insulated metal rod which terminates half way on the inside of the elastic watertight tube. The latter connects the junction with the heavy weighted base, which is also furnished with a rod that projects from it within the rubber tube, meeting the first rod to which the line is connected whenever the weighted end of the sounder is supported, as it would be when touching ground. When this instrument is suspended by the line, the weight at the bottom of the elastic tube incasing the contacts stretches the tube and separates the contacts from each other, keeping the circuit open. On the sinker fathoming, the elastic tube is released from the weight and contracts, bringing the rods together and closing the electrical circuit through the alarm, the weighted piece of metal on the bottom forming the ground connection.

The first experiments with the form shown in Figs. 1 and 2 were carried out in a large dock along the bottom of which logs of timber were permanently secured with a space of about two feet between each. As the sounder was hauled along from the deck of the launch and touched in succession the timbers, it caused the alarm to be sounded so accurately that the signals given corresponded exactly with the number of logs passed over. The water, however, was calm and only about twenty-eight feet deep and no great speed could be attained by the launch for want of space. The apparatus has since repeatedly proved equally as satisfactory under conditions which were as unfavorable as the conditions in the first trials were favorable.

The Immisch Motor.

Considerable attention has lately been drawn in England to the Immisch motor, which embodies some novel feat-

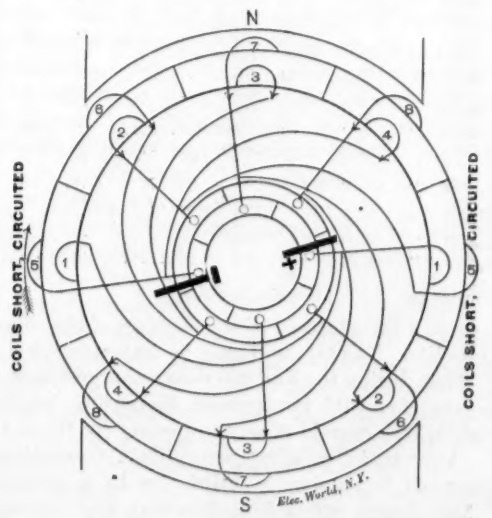


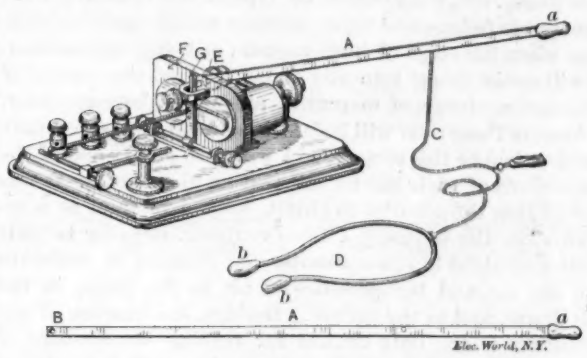
FIG. 2.—THE IMMISCH MOTOR.

ures, especially in the winding of the armature. The machine, of 6 h. p., is shown in perspective in Fig. 1, and the manner of winding the armature is shown diagramatically in Fig. 2. In the diagram only eight coils are indicated, although 48, 96 or more may be employed. The commutator is of the bisected type, and the coils are joined to two adjacent segments of the commutator on the two rings, of which one has an angular advance equal to one-half the width of the commutator bar. The two brushes side by side upon the two rings are connected together so that only one pair is shown in the figure.

Starting from one ring of the commutator under the brush, say, with coil marked 1, we cross to the other side of the armature and join the connection leading to coil 6; but if we follow this line backward to the commutator, we arrive at a segment under the same brush from which we started. Similarly coil 5 connects with coil 2, and is short-circuited in the same way by the other brush. It will be observed that the magnetic axis of the armature itself would be situated underneath the coils which are short circuited. The remaining connections are easy to follow; the two halves of the circuit can be traced through coils 6, 3 and 4 in series upon the one side, and coils 8, 7, 2 in series upon the other. It is to be observed, however, that this arrangement only amounts to the same as having an armature of normal type with a brush of wide face, so that its contact with two adjacent commutator bars is considerably prolonged.

It was thought probable when the first experiments were made that difficulties might be experienced from the heating of the coils during the period of short circuiting, which occurs twice in every revolution. No such effect has practically been found to occur so long as the field poles are properly proportioned, and, in the case of a motor, the brushes may even be shifted some distance to either side of the normal position without producing either sparking or any increase of heating. But curiously enough this does not apply to a dynamo of similar construction, the position of the brushes having to be adjusted with some care. So long as this is attended to, the machine runs with perfect smoothness, but as soon as the brushes are displaced, although no sparking takes place, yet considerable and rapid heating is the result. It is claimed, however, that this is of little practical importance, for when the position of the brushes has been once determined they can be rigidly fixed. It is said that the non-heating of the coil proves that during this part of the revolution the algebraical sum of the number lines of force passing through it is constant.

The average efficiency of one of these motors run at between 1,400 and 2,200 revolutions, and delivering from .98 to 1.76 horse-power, was 71 per cent. In a larger motor of from 4.5 to 5 horse-power, 85 per cent. efficiency was obtained.



FIGS. 1 AND 2.—A STRANGE TELEGRAPH RECEIVER.

A Curious Telegraph Receiving Instrument.

Numerous attempts have been made to overcome the alleged racking of the auditory nerves caused by the telegraph sounder, and various devices have been conceived for the purpose of receiving the impulses of the instrument. Among these the touch-sounder is now well-known, in which the clicks are taken off by the top of the finger, which is pricked by a pin attached to the armature-lever. It seems, however, that even this method is considered to entail strain and fatigue upon operators. To overcome both effectually, an inventor, William Arthur, of Gainesville, Fla., has devised an instrument entirely free from these defects, in that not the ear nor finger but the *mouth* becomes the receiver.

The peculiar device employed is shown detached in Fig. 2, and the whole apparatus is shown in side view, with the ear-press appendage attached to the rod. We will now let the inventor describe his instrument in detail:

"My device or instrument consists of a rod *A*, twenty inches long, one-half of an inch wide, and from one-sixteenth to one-eighth of an inch thick, made of pine, poplar, ash or other light material, and finished smoothly, but otherwise according to the taste of any one, the chief object being to get the correct and proper length and size. One end of this rod is inserted into and covered by a socket or mouth piece *a*, made of amber, gutta percha, or other non-conductor of electricity, the socket being tightly and firmly fitted and fastened on the rod, so as not to shake or rattle. Through the other end of this rod a round hole *B* is made, of any size required, to fit a telegraph receiving-instrument. Appended to this rod by a cord *C*, made of silk or other flexible and suitable material, is an ear-press *D*, made wholly of gutta percha, with oval-shaped knobs at ends *b b*, or the frame may be made of steel or any elastic substance, and the gutta percha knobs *b b* screwed on to the ends of the frame.

"My device or instrument is attached to the telegraph receiving-instrument, and adjusted for use, as shown in Fig. 1, and in the following manner: The rod *A* is placed

in position and fastened to the telegraph receiving-instrument by passing a screw *E*, through the hole *B* and through plate *F*, to where it comes in contact with armature *G*, and is firmly screwed.

"In operating and using my device or instrument the socket or mouthpiece *a* is raised to the mouth of the operator, and when the proper and most convenient angle is obtained rod *A* is made fast in that position. Then the operator should "cut out" the sounder, if one is used, and place an ear-press over his ears, or in lieu thereof stop up his ears with any soft material that will exclude the penetration of sound, and then place socket or mouthpiece *a* between his teeth. He will then be ready to receive dispatches, and, by the means above indicated, will be enabled to secure a more direct, distinct and perfect transmission of the electric click or sound of the telegraph to the senses than in any other manner or way, and thus be also enabled to receive and write out messages or dispatches more rapidly and accurately than by any other means and with more perfect secrecy. The ear-press can be conveniently placed upon or over the ears by opening the knobs *b b*, passing them behind the neck, and allowing them to press directly over or on the ear behind the cheek-bone. In the absence of the ear-press the ears can be stopped up in the manner above stated."

Glow Lamps, Their Use and Manufacture.

BY MAJOR-GENERAL C. E. WEBBER, R. E., C. B.

(*Continued.*)

The last stage, namely, the exhaustion, is probably that upon which the life of the lamp most largely depends. This process, exemplified by the action of the mercury pump which you see here, is apparently a very simple one, and would be so were it not that there are several small impediments to success which, when one comes to demanding a vacuum of one-millionth of an atmosphere, are very serious difficulties. In the first place, great attention must be paid to the construction of every part of the pump, for, with valves or taps of the ordinary kind, inevitable failure and waste of labor would ensue by leakage when the stage of high vacuum is being approached. I will avoid going into any description of the merits of the various forms of mercurial air-pumps, because Prof. Silvanus Thompson will before long read a paper on that subject before this society, so I will pass on to some of the conditions of their use for exhausting glow lamps. It was found that the attempt to obtain such a vacuum as is required in the industry I have ventured to bring to your notice to-night has to encounter the presence of moisture in the air, and the presence of air in the glass, in the platinum, and in the carbon. Besides, the process of exhaustion is the only vehicle for ridding the filament of what are called the occluded gases. A part of the moisture can be, and is, removed by absorbent substances placed inside the pumps, but alterations of temperature in the glass and in the filament, brought about by several means, which I cannot show here, are alone found to be really effective, and this application of heat to expel the moisture and air from the parts of the pump open to the lamp must be continued, with exhaustion, at certain stages of the operation, until by a suitable test it is found that the requisite degree of vacuum has been reached.

The best vacuum test is probably that which is made electrically. This is carried out with an induction coil of very high tension, and the test consists in observing when the sparks between two poles of platinum, placed in a part of the pump which shares the vacuum with the lamp under treatment, travels outside the glass instead of inside. The process of exhaustion in the early days of glow lamp making occupied three or four hours; now it has, by better appliances, been reduced in time to a little more than half an hour. The number of lamps turned out in a factory is determined by the number of lamps on each pump, generally three or four, and the number of pumps. Allowing ten removes a day, and twenty-five pumps, each having four lamps, a manufactory could turn out 1,000 lamps a day. The lamps are next tested and classified for candle-power and voltage, and marked accordingly; formerly 50 per cent. failed to give the standard of efficiency in those respects, now all are up to the mark within 10 per cent. The electrical efficiency of lamps is measured by the watts expended per candle-power. As is well known, economy in this direction effects a saving for a given amount of light required on an installation of electric lighting, in power converted into electricity, and in the size of the conductors which convey it to the lamps. Most makers' lamps vary between 3 and 5 watts per candle-power, when the lamps are new, under the conditions of voltage which give the longest life. Those are alleged to be as follows: Edison, 5 watts; Swan-Edison between 3.5 and 4 watts; Victoria, 3.5 watts; Woodhouse-Rawson, 3 watts.

The scientific man does not require to be told what are the tests to which he should subject glow lamps to prove their efficiency. At the Crystal Palace Exhibition, Vienna, at the Health Exhibition, and at Philadelphia, very exhaustive tests were applied to the lamps of several well-known makers; but at the best all these have proved unsatisfactory, because the makers themselves were not likely to contribute their average lamp, and in some cases either declined to contribute at all or repudiated the results after they were published. The tests which require apparatus not usually outside a laboratory are those which observe the E.M.F., the current, the resistance, and the watts per candle-power. There are various arrangements for testing candle-power. I am indebted to Dr. Fleming for that which is shown on the diagram (Fig. 4).

The arrangement is a very special one for securing an accurate E. M. F. in the lamp in process of testing. The disc *D* of a photometer is fixed, instead of, as is usual, being left free to slide. The standard flame at *S* is a lamp of burning pear-oil, or acetate of amyl, with a flame of regulated height. The lamp *I* to be tested is placed on a carrier which slides along the scale bar *A B*. First, to test the current. The current which feeds the lamps passes along the mains plus and minus, *via* the minus through a Thomson's graded ammeter and a platinoid resistance *R*, to one terminal of the lamp. The difference of potential between the termini of the coil is compared with the E.M.F. of a standard Clarke's cell C_2 on a potentiometer. This latter is a perfect check on the accuracy of the ammeter. Second, to test the working E.M.F. at the termini of the lamp. Similarly this is made with a Thomson's balance voltmeter *W*, as well as a Thomson's grade voltmeter V_2, checked by measuring the difference of potential at the extremities of a 100 ohm coil W_1, in series with a 10,000 ohms coil W_2. The voltmeters themselves are placed between the terminals of the lamp, but by means of the resistances the potentiometer, with a Clarke's standard cell, is only compared with $\frac{1}{1000}$ths C_1 of the E.M.F. of the lamp.

It will be understood that the standard cell in each is the ultimate check on the measuring instruments, provided the resistances are perfectly true, and if the latter do not agree with the former, they have to be recalibrated. The need for standardizing the measuring instruments used by electricians has been pressed home by Dr. Fleming to the conviction of every one concerned, but up till now little has been done beyond deliberation by a committee of the Society of Telegraph Engineers and Electricians. At present we do not know that we all mean the same thing when we speak of some of these units of measurement.

PHOTOMETER.

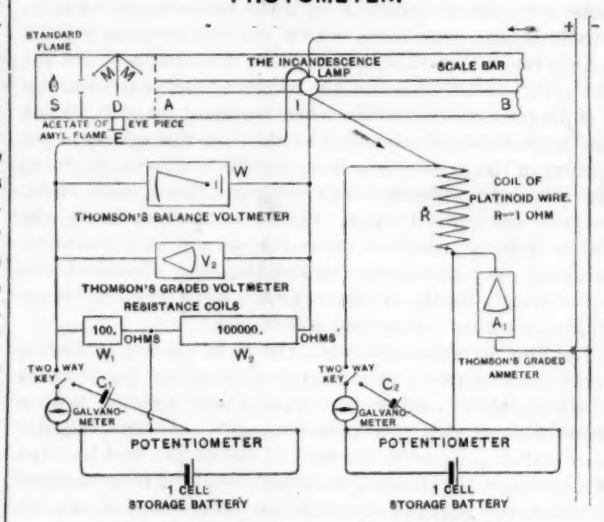


FIG. 4.—INCANDESCENT LAMP TESTING.

Users of glow lamps will be interested in the table shown, which is an average of several tests of the lamps of two or three makers:

Mean current and candle-power of two long-lived 100-*volt* 17 *candle-power lamps of different makers, run at* 100 *volts, and tested every* 100 *hours.*

	Initial current	=	.63 *a*	.....	c. p.	=	18.5*
After	100 hours	"	= .65 *a*	.....	"	=	18.8
"	200 "	"	= .65 *a*	.....	"	=	20.7
"	300 "	"	= .65 *a*	.....	"	=	18.5
"	400 "	"	= .65 *a*	.....	"	=	18.5
"	500 "	"	= .65 *a*	.....	"	=	18.5
"	600 "	"	= .65 *a*	.....	"	=	18.
"	700 "	"	= .65 *a*	.....	"	=	17.5
"	800 "	"	= .64 *a*	.....	"	=	15.5
"	900 "	"	= .64 *a*	.....	"	=	15.2
"	1,000 "	"	= .64 *a*	.....	"	=	15.2
"	1,100 "	"	= .64 *a*	.....	"	=	15.2
"	1,200 "	"	= .64 *a*	.....	"	=	15.2
"	1,300 "	"	= .64 *a*	.....	"	=	15.2
"	1,400 "	"	= .64 *a*	.....	"	=	15.2
"	1,500 "	"	= .63	.....	"	=	13.7
"	1,600 "	"	= .63	.....	"	=	12.7†

*3.4 watts per c. p. †5 watts per c. p.

This gives a little history of the changes of the filament during its life. The tale told may be summarized as follows: That during the first 200 hours the resistance decreases slightly, with consequent increasing brilliancy. These conditions remain nearly stationary for the next 500 hours. After that they alter perceptibly, increasing the resistance and decreasing in brilliancy in a progressive ratio. But it must not be forgotten that the increase in resistance of the filament is not the sole cause of the loss of light. As the filament ages, its original smooth surface roughens, and is consequently increased in area in larger proportions than it would naturally be decreased by the loss of bulk. The larger surface requires more current, whereas the increased resistance is gradually reducing the supply. Another cause of the loss of light is due to the blackening of the glass by a carbonaceous deposit, which also increases with age. This latter loss in 1,000 hours' consumption amounts, in a good lamp, to 15 per cent. This clouding over of the lamp bulb is due to an internal deposit due to the disintegration of the material, either of the wire mount or of the filament.

Dr. Fleming gave the Physical Society in 1883 and 1885 a description of some curious phenomena incidental to this aspect of the use of glow lamps. It is sufficient for our purpose to mention the cause and the effect. As time goes on in the life of a glow lamp a smoky deposit is apparently inevitable; but, quoting Dr. Fleming, "In normal use, when the lamp is not being pressed beyond the E. M. F. at which it is intended to be used, there is a general evaporation of carbon going on from all parts of the loop." His experiments tended to show that when an excessive temperature is given to the filament by a higher E. M. F., the molecules are projected with violence against the glass, causing by the more rapid disintegration an earlier obscuration of the globe than should arise under normal conditions of consumption. The rate at which the clouding takes place is rapid in the case of some defective filaments. But as a rule makers have conquered this difficulty, and it takes place under conditions which are preventible. The loss of light is very slight, and the appearance of a clouded lamp by daylight is, I think, its most objectionable feature.

Any user of glow lamps on his own installation will find, when he replaces old ones by new, that the latter will give more light, so that if he introduces a new lamp to replace one which has been broken at a period when most of the lamps are, say, 900 hours old, he will perceive a difference of about two or thee candles if he uses 17 candle-power lamps. If the old lamps are, say, 1,700 hours of age, he may find a difference of seven or eight candles. As the current is not economized in proportion to the loss of light, he should recollect that a point may be reached when, by continuing the use of old lamps, there arises an important waste of power. Hence the public should judge of the efficiency of lamps outside certain limits more by their constancy of candle-power rather than by their length of life. Thus the best lamp is that which lives the longest with least variation of light.

(TO BE CONTINUED.)

A New Electrolyte for Galvanic Batteries.

It is well known that several salts found in the natural state are capable of being employed as electrolytes in galvanic batteries, but as yet they have not come into general use, for various reasons. Recently, however, there has been submitted to our notice a specimen of what is termed "coquimbite," a mineral salt to be found in large quantities in South America, and of which a specimen has been brought to this country by Mr. Wm. C. Quinby, who has recently patented its use in batteries as a depolarizer.

Coquimbite is an anhydrous sulphate of the sesquioxide of iron. The analysis of the salt shows that in one hundred parts it contains thirty-five to forty-five per cent. of anhydrous sulphuric acid, and from twenty-five to thirty per cent. of anhydrous sesquioxide of iron, the remainder being water of crystallization and traces of other metals, or oxides. Its color varies from sky blue to yellow, garnet, coffee color and almost black The light-colored pieces when broken are translucent. Upon exposure to the light and in a moist atmosphere the salt assumes a dark resinous appearance, and in time changes to a yellowish tint, not unlike that of the yolk of an egg. When exposed to the heat of a furnace, all the different colors change to the yellowish hue mentioned above, and as the heat continues the salt gives up the water of crystallization, and finally its sulphuric acid, leaving in the retort the sesquioxide of iron in the form of very fine powder of a light gray color.

Mr. Quinby states that this salt when employed in the battery prevents all polarization, no gases being developed, the hydrogen combining with the sesquioxide of iron. The sulphuric acid of the electrolyte, having a greater chemical affinity for the electrodes of the cell than it has for the sesquioxide of iron, attacks the electrodes, giving up the sesquioxide of iron, which combines with or holds the hydrogen, and by gravitation settles to the bottom of the cell in the form of a light-gray powder, where it may be recovered and again converted into a hydrated sulphate by combining it with hydrated sulphuric acid (acid of commerce). This hydrated sulphate being reduced with water or other solvent, forms an electrolyte or exciting-fluid, the chemical and electrical action of which is nearly the same as that of the natural salt, but of less efficiency, for the reason that the oxide has already combined with a certain amount of hydrogen when it was liberated by the action of the cell, and there being traces of nitric acid in nearly all of the sulphuric acid of commerce, there is developed by the combination of this trace of nitric acid with the hydrated oxide a certain amount of anhydrous sesquioxide of iron, which gives to it the only value it possesses. On open circuit no action takes place in the battery.

Electrical Journalism.—THE ELECTRICAL WORLD, of New York, has published a neat little pamphlet containing interesting particulars of the growth of the WORLD and its predecessor, *The Operator*, during a period of nearly thirteen years. The comparative statistics presented at the end of the volume, however, are not particularly valuable, as it is idle to compare an enormous country like America with the limited space and enterprise existing in England.—*London Electrical Review.*

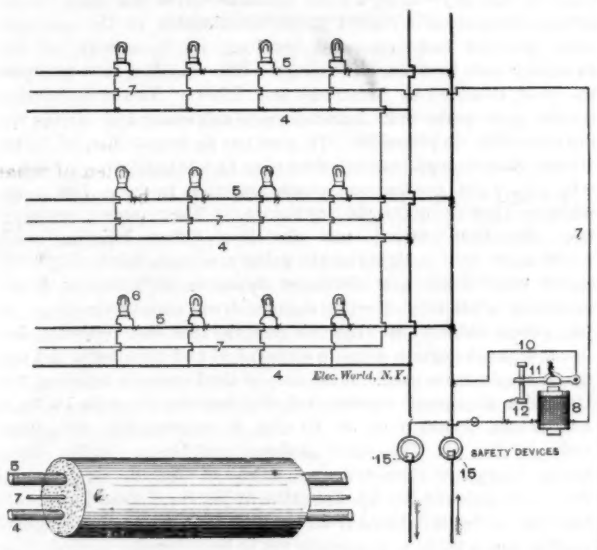
Government Telegraphs in Canada.

With regard to the telegraph troubles in Canada, a special dispatch of Jan. 12 says:

The recent trouble between the Great Northwestern Telegraph Company and the Montreal Telegraph Company has revived the agitation in favor of the Dominion government assuming control of the whole telegraph service of Canada. The government only owns and operates such lines as have been built in furtherance of the public service. These lines have mostly been constructed in connection with the signal service along the Gulf of St. Lawrence, the Maritime provinces and British Columbia, and also for the advancement of settlement in the sparsely settled districts of the Northwest territories. The last official return of government lines in operation places the total length at 3144 miles. In 1885 the cost of maintaining and working them was $70,977, on account of which $46,419 was received as revenue, leaving a deficit of $24,558. According to the last published estimate, there were 24,100 miles of public lines in Canada, with 2,415 offices, and since that date the Canadian Pacific Railway Company have added several thousand miles to the telegraphic system of the Dominion, the figures relative to which have not yet been made public. As an evidence of the largely increased telegraphic accommodation in Canada since confederation 20 years ago, it may be said that on Dec. 31, 1867, the total length of all telegraph lines was 7,227 miles, with only 497 offices, or one office to every 7,042 of population. On June 30, 1875, there were 24,100 miles of line, 2,415 offices, or one office to every 1,944 of the population.

Safety Circuit for Electric Lights.

Experience has shown that while the insulation of wires used for electric light purposes may be perfectly fireproof, danger is apt, unless it is also waterproof at the same time, to arise from moisture causing a short circuiting of the wires and giving rise to abnormal currents. In order to avoid the possibility of a short circuit occurring from such a



FIGS. 1 AND 2.—SAFETY CIRCUIT FOR ELECTRIC LIGHT WIRES.

cause, Mr. Edwin T. Greenfield, of this city, has recently invented an arrangement by which each electric light circuit is combined with a neutral or safety wire. The latter is placed in connection with an indicating or safety device, such that the current diverted by the moisture gives an alarm or cuts out the circuit where the danger exists.

The diagram, Fig. 1, shows one of the methods of accomplishing this result. The neutral wire 7 is run along with the conductors 4, 5, and is inclosed in the same winding that covers the conductors, as shown in Fig. 2. The safety wire 7 is connected to an electro-magnet 8, and thence by wire 9 to the negative wire. There is also a branch wire to the armature, and another wire to the front stop of the magnet; so that when the current passes through it, the armature will be attracted and will short-circuit the current, and so cause the fusing catches 15 to act. In this way the lighting circuit is protected from overdue heating.

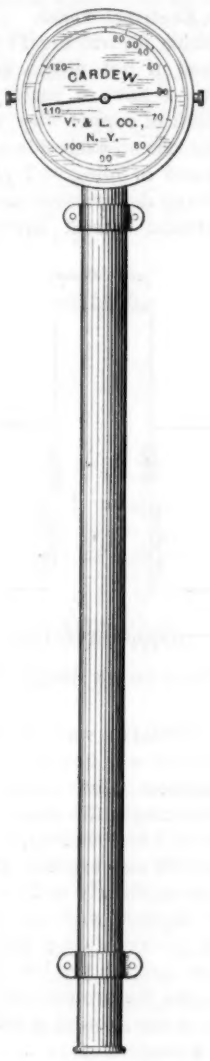
An Electric Safe Lock.

A new electric permutation safe lock, says a contemporary, has just been brought out by a Chicagoan which differs materially from all other safe locks in the fact that there is no orifice to speak of in the door of the safe. The dial has no connection in this invention, except by electric wires, with the body of the safe, and may lie on the cashier's desk or repose securely in his home, free from any possible violence of the burglar's hammer. The mechanism is very simple. The dial rests in a magnetic block, from which wires extend and communicate with magnets which set up the tumblers in the lock, and so permit of the throwing back of the bolt-bar. This releases a spring or body of compressed air, as the case may be, which in turn releases the heavy bolt-work. The wires penetrate the top plate of the safe at the jamb of the door and move in a zigzag course through the inner plates to the lock. The wires are so small and their course so crooked that, it is claimed, they cannot be traced by explosives. A current of electricty is obtained from several small batteries by pressing down a key on the vulcanite block that holds the dial. The dial, when not in use, can be detached from the vulcanite block and carried in the pocket. The door of a safe whose lock is controlled by this electric apparatus will present to the burglar none of the spindles which penetrate the walls of the ordinary safe and yield so conveniently to the influences of the blowpipe, but simply a knob for opening the door which only penetrates the first plate.

The Cardew Voltmeter.

The measurement of electromotive force in commercial practice in England is to a large extent done by Cardew's voltmeter. Unlike other instruments for measuring potentials, it is not based upon either permanent or electro-magnetic attractions, consequently it is not subject to change of magnetism due on the one hand to the earth's influence and surrounding or neighboring masses of iron, and on the other hand to the crystallizing of the iron in electro-magnets.

The Cardew depends for its operation upon the expansion due to the current, of a given length of very fine wire of a special composition of platinum and other metals. A peculiar arrangement compensates for disturbing conditions, and compels its correct indications. About twelve



THE CARDEW VOLTMETER.

feet of wire is used for the expansion, so that the heat developed in any part is trifling, and in a few seconds reaches its maximum for the given potential.

The actual size of the instrument shown in the accompanying cut is about 42 inches long, with a 6-inch dial. The scale is prominent, with large divisions, which, above 40 volts, readily permits the reading of ¼ volt. The Cardew voltmeter may be left on the circuit for any length of time, and two or more may be placed in series, and a correct reading obtained by adding the several readings of the series. The Vitrite and Luminoid Company, of this city, have secured the rights for the instruments in this country, and will shortly begin their manufacture here. The needle, it may be added, is dead beat, and instantly responds to any change of potential in the circuit being measured. As the instrument may be safely left in the circuit, this sensitive quality of the needle is one of great value to those constructing or testing constant potential dynamos, as also experimenters on arc lamps. In the former case the exact points are determinable where the change of lamp-load produces a rise or fall, and in the latter case the action of the feeding magnets can be very accurately plotted. The instrument is also well adapted for measuring the potential of alternating currents.

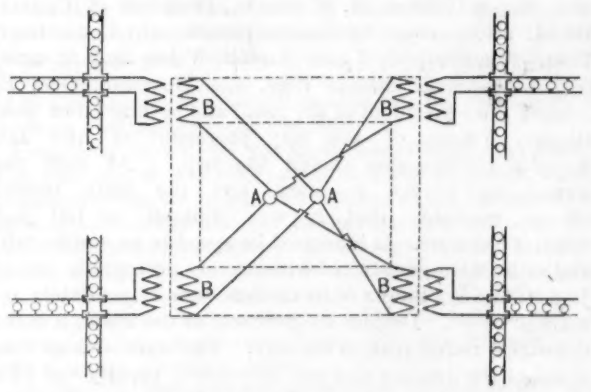
Erie.—The Erie Telephone Company has declared a dividend of 1 per cent., payable Jan. 24 to stock of Jan. 7. The receipts for the quarter were $34,500, an increase of $5,000 over any previous quarter. A surplus of about $16,000 will remain after paying this dividend.

Distribution by Transformers.

We learn from the *Œsterreichisch-ungarisches Patentblatt* that Messrs. Siemens and Halske propose to effect the distribution of electricity from central stations by subdividing the area to be supplied into several smaller districts, and distributing electricity in parallel mains in each such sub-district by means of large transformers, which are themselves to be supplied with current from the central station. In the publication from which we obtain these details Messrs. Siemens and Halske set forth the disadvantages attending the employment of transformers upon parallel circuits, such as the amount of copper which is required for the mains (since the potential must be kept constant and equal at every transformer on the circuit, irrespective both of the number of lamps and of transformers in use), and also the objection of bringing into the consumer's premises very nearly the full tension of the dynamo. They then refer to the difficulties connected with the regulation of transformers when connected in series, for which no solution has yet been made known, and, finally, they explain a method of connection by which it is proposed to obtain perfect regulation without incurring the difficulties of the parallel system. The connections proposed are shown in the accompanying figure, where *A A* are the terminals of the alternating current machines at the central station. Any required number of machines joined in parallel may be employed. From these points mains are carried direct to the terminals of the primary coils of the transformers (*b*) in each sub-district, and the latter are again joined in parallel by additional sub-mains, as shown by dotted lines.

Commenting on this method of distribution, the London *Electrician* says:

"The authors state that the dimensions of the sub-mains will be so taken as to provide an adjustment for all ordinary discrepancies between the rates of consumption in different districts. In order to provide against *extraordinary* departures from the normal balance, they contemplate the introduction, when necessary, of resistances in the circuit of the main leads of those transformers which are doing minimum work. But it appears to us that the whole of this part of the scheme is based, to some extent, upon a misconception. In giving an illustration of the supposed action it is stated in so many words that if the



A "TRANSFORMER" SYSTEM.

potential at the machines remains constant, then the current in the main lead belonging to any given transformer tends to *increase* when the number of lamps in the secondary circuit of that transformer is *diminished*. It is, however, tolerably well known (and it may readily be proved by theory) that the reverse is really the case. An easily-remembered rule of thumb clue to the elementary conditions of transformer circuits may be given by stating that *the virtual resistance of the primary coil varies in the same direction as the actual resistance of the secondary*. Consequently, when lamps are turned off the actual resistance of the primary is increased, and under constant difference of potential the current through the coil diminishes (instead of increasing, as stated by Messrs. Siemens and Halske). Owing to the loss of potential in the mains, this decrease of current tends to cause a slight rise of potential at the terminals of the primary; but in the system under consideration this is to some extent counterbalanced by the fact that the presence of the sub-mains diverts into this route a portion of the current passing through the other primary coils. The proportion of current so diverted obviously depends solely upon the relative resistances of the various mains and sub-mains. To secure perfect compensation in this way it is necessary that the resistance of all the mains be equal to one another, while the resistance of the sub-mains ought to be a vanishing quantity (!) In fact, as above intimated, the particular connections described have nothing to do with transformers *qua* transformers, but resolve themselves into a system of parallel mains with feeders by which the difference of potential may be kept approximately uniform at all points.

Electric Stop Motions.—Riley & Gray, Boston, have over 1,500 deliveries now contracted for different mills, on drawing frames with electric stop motions. The Amoskeag Manufacturing Company, Manchester, has placed a second order for electric stop motion drawing frames of 128 deliveries. Their former order was for 384 deliveries, now making 512 deliveries in all, being the largest quantity of this drawing in any one corporation in this country.

The Daft Electric Road at Los Angeles, Cal.

The first car on the new electric street railway at Los Angeles, Cal., was run successfully on New Year's evening. The road is nearly three miles long, and cost about $50,000 to build. Mr. A. H. Hayward has had charge of its construction on the Daft system. He had charge of the electric railway in Baltimore. The generating works are located about a mile from the present street car line. This is only a branch of the main line, the construction of which is to be commenced at once. At present a thirty horse-power engine and a dynamo do the work. When the main line is completed a larger engine—of 150 horse-power—will take the place of the one now in use. The wires are suspended over the track, drawn tight, and rest on iron hooks secured to brackets, which are fastened to poles about sixteen feet high and about twenty feet apart. These poles are four feet from the track and in a straight line with it. On this double wire runs the little "trolley," which takes up the electric current for the dummy, to which the passenger-coach is attached in the usual way. The dummy is a short, compactly-built car. It contains the motor and room enough for the engineer and two or three other persons, but carries no passengers. Besides this, they have another car with the motor in the centre, entirely closed in, and the regulating apparatus at either end for use by the engineer, as convenience may require. The car has also a seating capacity of thirty passengers. A half-mile run was made in two minutes and thirty-five seconds. This part of the track was slightly down grade. A mile was made on apparently level ground in about five and a half minutes. The cars were started and stopped very smoothly and easily, much more so than on a horse or cable car line. The managers are very enthusiastic over the success of this new enterprise. They claim that it is much more economical to build and cheaper in its running expenses than the old style of lines.

Speaking of a special trip made on Jan. 4, the Los Angeles *Times* says:

Yesterday afternoon, as per invitation of Col. Howland, the originator and builder of the road, a party of city officials, with newspaper representatives made a trip. The vicinity of the present eastern terminus of the road (Pico street, at Main) was occupied by several hundred interested spectators, including many ladies. Among the passengers were Mayor William H. Workman, President of Council Breed, ex-President of Council Sinsabaugh, Councilmen Teed, Frankenfield, Jones, Lovell, Velsir and Stearns, Superintendent of Streets Pike, Col. Howland, Gen. E. Bouton (vice-president of the road) and several other gentlemen. Some of the lady professors of the Los Angeles College also shared the trip. At 3:03 the signal was given to start, and the train moved off so smoothly that it was difficult to tell just when it did start. It increased its speed to an 8-mile gait, and sailed along westward without any perceptible jar or jolt. The smoothness of its motion was immediately remarked by all. Despite the newness of the track, it is the smoothest riding road in the city. The train—which consisted of the dummy and one car—rolled rapidly out Pico street, climbed the steep grade just beyond the Williamson tract successfully, rounded the curve at the city limits, climbed the steep grade beyond, and soon reached the drive to Rosedale Cemetery, 2½ miles from the point of starting, having made the distance in 15½ minutes—a handsome rate of speed for a street railway. Here a brief stop was made before starting on the return trip. Every one was delighted with the speed, smoothness of running, perfect control, suavity of stopping and starting, and everything connected with the road. Col. Howland and Gen. Bouton were loaded down with congratulations. Mayor Workman acted as engineer throughout the trip, and did his work like an expert. The cars are from the famous Brill works, Philadelphia, are very attractive, very roomy and very comfortable. There are three of them, one of which carries its own motor without appreciable diminution of room. The cars yet to arrive will also be of this description. The road will probably not be fully open to travel this week, as it is desired to have every detail in absolutely perfect order. The iron and other material for extending the line to the plaza is now on the way to this city, and the additional two miles of road is expected to be done in 60 days. It will undoubtedly be a paying institution from the start.

Native Improvements in Telegraphy in Tonquin.

An extract from a private letter received from a lieutenant in the French Army of Occupation in Tonquin gives, says the London *Electrician*, an amusing account of the difficulties which have to be encountered in the maintenance of the telegraph lines in that country. On one occasion communication between Hanoi and Haiphong was totally interrupted, and several days elapsed before the locality of the fault could be detected. At length, after traversing the whole length of the line without discovering the fault, the officer in charge observed upon his way back that in the neighborhood of one of the villages of a friendly tribe the line seemed rather thicker than elsewhere, and on a closer inspection it was discovered that several miles of the wire had been removed, and had been carefully and neatly replaced with bamboo rope. The headman of the village explained that iron wire was a valuable commodity in his district, but as a proof of his affection for the French he had issued the most stringent orders that whenever any wire was removed from the line, repairs were immediately to be effected in the manner described. The officer attempted to explain the difference between conductors and non-conductors of electricity, but eventually found it more to the purpose to intimate that any future supplies of bamboo rope for telegraphic purposes would be utilized for the summary execution of the nearest headman.

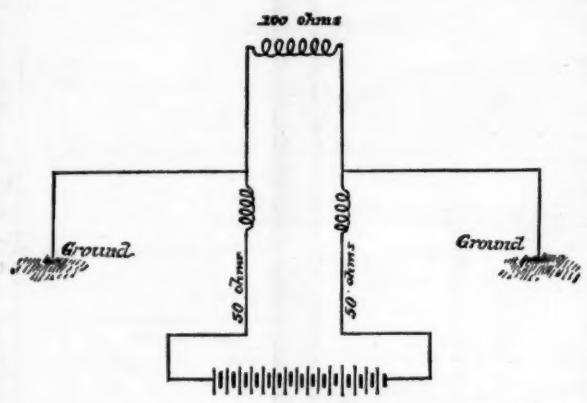
Specific Inductive Capacity.

At a recent meeting of the Cambridge Philosophical Society, a new method of determining specific inductive capacity was described by Mr. L. R. Wilberforce. It consisted in the comparison of the directive couples upon two spheroids, the one made of the dielectric to be investigated, and the other of some conducting material, when they were placed in a uniform electric field. Mr. Wilberforce further indicated certain theoretical considerations with regard to the eccentricities of the spheroids and their manner of suspension, and stated a general theorem relating to the mechanical effect due to such a field upon a body of any material or form.

A Problem in Resistances.

To the Editor of The Electrical World:

SIR: Will you kindly inform me if I am correct on the following or not; and if not please give me the correct idea on the subject. I have a battery of ten cells and have a metallic circuit of copper wire whose resistance is about 200 ohms. I place on each side of this circuit a good ground connection and in doing so I place it so that the wire not in use between the grounds measures one hundred ohms, and the ground circuit measures one hundred



A PROBLEM IN RESISTANCES.

ohms. Now this affords two ways for the current to travel. I claim that the current will flow in the two ways in proportion to the resistance. I have made this test and find that the whole resistance is 150 ohms, when without the ground circuit it would be 200 ohms, or without the shunt on the ground it would also remain 200 ohms. I inclose a diagram that you can clearly understand what I mean. Other parties here disputed with me and I have also received letters from experts stating that I am wrong, and that there is no flow through the 100 ohm portion and that it will all flow through the ground circuit. I should repeat that the resistance of the ground is 100 ohms. M. M. W.

ERIE, Pa.

[If, as our correspondent states, the resistance of the *ground* is 100 ohms, it follows that when the ground is inserted, the total resistance of the circuit is made up of the two 50 ohms, and a divided circuit having 100 ohms in each branch, or 50 ohms. The total resistance is, therefore, 150 ohms, as he says. Our correspondent has probably failed to state to others that the ground had a resistance of 100 ohms, which does not appear from the diagram.—EDS. E. W.]

The Study of Thunderstorms.

There still remains an immense amount of patient work to be done in the way of protracted and careful observation before the phenomena of thunderstorms can receive anything like complete elucidation. Dr. Hann, of Vienna, has recently contributed a valuable monograph upon this subject. From a study of thirty-two years' observation of thunderstorms in the Vienna region, Dr. Hann finds that there is a double maximum of frequency. The greatest number occur in the first half of June; the second smaller maximum is in the end of July; between these is a secondary minimum. (Thunderstorms hardly ever occur in winter.) This agrees with observations in Munich. In Brussels most thunderstorms occur in the second halves of June and July. The daily period in Vienna shows a chief maximum about 3:20 P. M., and a secondary one at 1:20 A. M. The spring and summer storms come mostly from the east and southeast, and seem to belong to Mediterranean depressions, coming up from the Adriatic, as those of late summer seem to be on the south or southeast border of Atlantic depressions.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Jan. 17, 1887.

The Bermuda steamer "Orinoco" is being equipped with electric lights by the Mather Company (Perkins incandescent system). A 165-light machine has been put in and 139 lights have been wired for by Messrs. J. B. Platt and C. E. McKay, who are doing the work. More lights will probably be added. Of those now up, 6 are in the engine room, 3 in the shaft tunnel, two 4-light groups in the cargo hold; 30 in the main saloon, 12 in the after saloon, 6 in the social hall; all 16 c. p. The others are in the berths, etc. A Payne upright engine is used.

The New street telephone exchange is to be discontinued about the middle of next month, the building it is in being about to be pulled down. The subscribers will be distributed, most of the wires being taken in by the John street exchange.

Mr. G. M. Horton, in the *Tribune* Building, is exhibiting the Synchronous system of electric time, of which you published a description last August. One of the special features of the system is the ease with which the secondary works or attachment can be placed on almost any clockwork, a very good point where parties have clocks with valuable movement, and do not wish to displace them for commoner, though desirous to have electric time. The Synchronous fixture in Mr. Horton's office is attached to a very fine marine movement, and every hour an electric impulse from the primary regulator causes a lever to move, actuated by a magnet, which sets the hands to the exact hour as indicated on the regulator.

It has been suggested to me that now so many electrical conduits are being put down, it would be a good thing to season them with fernoline, already so well-known as a preservative for wood and metal. I give the idea for what it is worth. The Fernoline Chemical Company, No. 18 Broadway, are the sole proprietors and patentees, and have some remarkable testimonials.

The Kings County Grand Jury, which is supposed to be investigating the workings of the Electric Light Company in Brooklyn, went into Court one day last week, and asked if they had the right to examine the books of a corporation. They had, Judge Moore said, if it would throw some light on a criminal transaction. The court refused to listen to the reason for examining the books. The inquiry, which extends also to the telephone companies, and to the Electrical Subway Commission, is attracting a good deal of attention—with what result we shall perhaps see.

Mr. E. T. Lynch, Jr., of the United States Illuminating Company of this city—doing a local business—gives me some interesting information in regard to the illumination of the magnificent enlarged and renovated building, on Broadway, of the Equitable Life Insurance Company. The building now occupies the block bounded by Broadway and Liberty, Nassau and Cedar streets, goes down in its foundations to tidewater and strikes the heavens with its pinnacles. It now has an installation of 5,000 United States incandescents of 16 c. p. and 50 of 100 c. p. which will fitly light up the rooms and interior spaces. The plant includes seven 600-light dynamos. The same company has also been fitting out the Post Office building with 1,000 more 16 c. p. lights on the gallery, second, third and fourth floors, etc. Four new 250-light dynamos have been put in, driven by a 140 h. p. Corliss engine, from countershafting. I judge from this and Mr. Lynch's remarks that the company believes in large engines as more economical and quite safe. All underwriters' wire is used. In the case of the Equitable building, the Callender Company furnished 2,000 feet of cable with 19 No. 6 conductors, 2,000 feet of 19 No. 9 conductors, and three miles of No. 0. The India Rubber and Gutta Percha Insulating Company furnished two miles of No. 2, six miles of No. 4, ten miles of No. 14, five miles of No. 8. I should also state that the power is derived from a 450 h. p. Watts & Campbell Corliss, and a 60 h. p. automatic yet to be ordered.

Mr. T. L. Fowler, the genial manager of the Ansonia Brass and Copper Company, says they were never so busy as now. The underwriters' wire department has orders months ahead, while the concern is as actively employed as usual on its bare wire, seamless copper tubing, "Acme" bronze telegraph and telephone wire, electric light fixtures, and other specialties familiar to every man in the electrical business.

Mr. J. J. Williams, of the house of J. Duval & Sons, 100 John street, claims that the firm was the first in this country to manufacture battery zincs. It does not pay as much attention as before to that part of the business, on account of the competition in it. It is quite busy on copper wire, copper for electroplating and general use, and smelter's zinc, especially for battery uses. The firm has a big factory and rolling-mill in Brooklyn, near the bridge, and has, moreover, a long list of old customers.

The following is of interest, though perhaps not altogether new. I clip it from the New York *World* in an article on the big Brooklyn Bridge:

"Passengers on the cars cannot but have noticed the wires which are strung along the iron work of the bridge directly under the promenade. The space between the tracks of the railway is occupied almost entirely by these wires. Should any one be sufficiently interested to guess the number, he might place it at about fifty, but such an estimate would prove entirely erroneous, for there are no less than 293, including the Commercial cable. Until the bridge had been completed it was necessary, in order to secure telegraphic and telephonic connection between the Metropolis and the City of Homes, to sink cables under the East River. That this was a costly undertaking goes almost without the saying, and it need hardly be stated that the corporations interested were quick to see the advantages which the bridge presented over the old method. Requests for permission to utilize the big suspension as a sort of electric conduit poured into the trustees long before the span was completed, and a new source of revenue was discovered. A rental of $30 per year was demanded for each wire, and the telegraph and telephone companies readily agreed to pay the sum. As a result $9,010 a year is now received by the bridge authorities for privileges which really cost the two cities nothing, but are really worth much more to those to whom they are granted. The Commercial Cable Company pays $250 per annum for the right to rest its cable upon the iron girders of the structure. The largest sum, however, is paid by the Metropolitan Telegraph and Telephone Company, which contributes $5,880 every year toward the maintenance of the bridge as rent for its 196 wires. Considering

that this is more than half of the entire amount received for such service the figures give a fair idea of the dimensions which the telephone industry has assumed in a short time. The Baltimore and Ohio has 38 wires, the Western Union has 20 and the Law Telegraph 14. The remainder are owned by private individuals and firms."

It is said that the Metropolitan Telephone Company will begin at once to pull its cables into the Sixth avenue conduits from Twenty-third up to Fifty-ninth streets. Some of the sections of conduit are reported in bad condition. The Metropolitan Company has made an application to the Subway Commissioners for permission to string 50-wire cables on the pole line in Fifty-eighth street from Sixth avenue east, to be utilized for the accommodation of its customers until proper subways have been constructed, when it agrees to bury these wires. This application will have to go before the board, but it is not expected that it will meet with any opposition, as the Commissioners are empowered in their discretion to grant such temporary permits.

The Western Union Company has made an application for permission to string three cables of nineteen wires each under the elevated railroad structure in Ninth avenue in the same manner as the cables are now strung on Third avenue. The permit is asked only to cover the time which may elapse until conduit accommodations are provided by the Commission for the cables, and the company agrees, if the application is favorably considered, to take down about 100 poles which are now used for carrying its wires along the route before June 1 next.

At the meeting of the American Electric Manufacturing Company last week, Mr. James J. Wood, the electrician of the corporation, presented to the directors some new and improved features in his system. Mr. Wood's changes are said to be very valuable and important. Some of them are in the dynamo, to guard against accident or its results, and he has also succeeded in putting some touches on his remarkable automatic regulator. He has altered the lamp in mechanical details, causing it to burn more steadily, and doing away entirely, it is said, with flickering. He has in addition invented an ingenious ammeter of new principle, and which for cheapness and quality is reported to stand foremost. Mr. Wood also stated at the meeting that he had effected improvements in the cut-out. The company declared a 1½ per cent. quarterly dividend and is earning at the rate of 10 per cent. Col. W. A. Stedman, who was a short time ago elected to the position of Treasurer, was introduced to the directors at the meeting last week. He has had a long experience in the illuminating business, having been an expert gas manufacturer and manager for a period of about 25 years. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Jan. 17, 1887.

Mr. Gardner S. Lamson has succeeded Mr. John P. Gregory as the Boston agent of the Union Glass Company.

Mr. Frederick Swift, Treasurer and Manager of the Sun Electric Company, of Woburn, Mass., has returned to Boston after several months' sojourn in San Francisco.

Mr. W. C. Maybury, President of the Detroit, Mich., Motor Company, is on a short visit to this city. Mr. Maybury is a member of Congress from Michigan, and has many friends among the electric light people.

The Ries Electric Railway Manufacturing Company, which was organized in Portland, Maine, last week, will have offices at No. 54 Devonshire street, Boston.

The Wainwright Manufacturing Company report that their business has increased so fast that they are again obliged to enlarge their factory at Medford, Mass., and have decided to erect a new building 105 feet by 36 feet, to contain offices, store room and erecting shop.

The annual meeting of the Page Belting Company, of Concord, N. H., occurred in that city on Jan. 15. The following officers were elected, viz.: G. F. Page, President; C. F. Page, Treasurer, and L. D. Stevens, Clerk.

A trip to South Framingham, Mass., and Fitchburg, Mass., was recently made by the senior electricals of the Institute of Technology to examine the electric railway signals on the Boston & Albany and Fitchburg railroads.

The Commercial Telephone Company, Limited, of Trinidad, has enlarged its exchange, having recently received from the Tropical American Telephone Company, of Boston, 57 new sets of instruments. During the past twelve months the latter company has furnished the former with 112 complete sets of instruments.

Advices from Hamilton, Bermuda, report the incorporation of "The Bermuda Telephone Company, Limited," for the purpose of establishing communication by telephone between the towns of Hamilton and St. George. The Tropical American Telephone Company, of Boston, was given the contract to furnish the necessary instruments, and has already shipped an outfit for 100 subscribers, with prospect of filling an order for 100 additional sets of instruments in a few weeks.

Mr. George H. Hartwell gave a novel and interesting lecture a Tremont Temple on the evening of January 12, the subject being termed "Harnessed Lightning." The platform was covered with electrical apparatus, which was described in detail by the lecturer.

The Mineral Springs Manufacturing Company, at Stafford Springs, Conn., has introduced electric lighting into its woolen mills.

The Westbrook (Maine) Paper Mills have adopted incandescent electric lights in preference to the illuminants heretofore used.

Many of the electric light companies are learning to appreciate the merits of the Wheeler reflectors; and this is fully substantiated by the numerous orders recently received from that source by the Wheeler Reflector Company of Boston.

Electric lights are in demand in Malden, Mass. There are at present sixteen lights located on the main thoroughfares, and petitions for fifty more arcs have been presented to the city government.

The Selectmen of Stoneham, Mass., have granted to Nathan J. Simonds, of Woburn, Mass., the right to erect poles and string wires in the former town for the purpose of furnishing incandescent electric lights from his Woburn plant.

The Boston & Albany Railroad managers are experimenting with a system of lighting its cars with electricity. Heretofore these attempts have failed when put into practical operation, the use of primary batteries having been the principle employed. Now, however, a new way is being tested, and apparently it is a success. The first test of the new method was made Friday, Jan. 14, on the 4.45 P. M. train on the Circuit road. The car No. 90 has been fitted up with ten incandescent lamps of twenty-five candle-power, while each platform is lighted by another lamp. The power or light is derived from two storage batteries or accumulators placed in suitable receptables under the car, and these storage batteries are said to be sufficient to supply the light 8½ hours. The Julien Electric Company of New York equipped the car.

Mayor O'Brien, in his annual message recently read before the Common Council of Boston, presented interesting facts and figures on the cost of lighting the city with electricity, gas and oil during the years 1885 and 1886, together with tabular statement showing expenditures for each of the illuminants, the number of lamps of all kinds in use during 1885 and 1886, and the names of the companies furnishing the electric lights:

The cost of gas for street lighting during the year ending Dec. 15, 1885, was	$255,059.59
The cost of gas for street lighting during the year ending Dec. 15, 1886, was	262,251.17
Increase during the present year	7,191.58
Cost of oil for street lighting during the year ending Dec. 15, 1885, was	5,141.63
Cost of oil for street lighting during the year ending Dec. 15, 1886, was	5,237.12
Increase during the present year	95.49
Cost of electric lighting during the year ending Dec. 15, 1885, was	99,523.28
Cost of electric lighting during the year ending Dec. 15, 1886, was	108,491.87
Increase during present year	8,968.59
Cost of lighting and care of street lights during year ending Dec. 15, 1885, was	103,074.32
Cost of lighting and care of street lights during year ending Dec. 15, 1886, was	105,615.83
Increase during present year	2,541.50
Total expenditure for all purposes during year ending Dec. 15, 1885, was	$497,080.00
Total expenditure for all purposes during year ending Dec. 15, 1886, was	$513,174.30
Increase during present year	$16,094.30

The number of public lamps of all kinds in use in the city of Boston on Jan. 1, 1886, was, viz.:

Gas	9,978
Oil	2,630
Electrics	446
Large gaslamps	63
Total	13,117

On the 1st of January, 1887, the number was, viz.:

Gas	10,057
Oil	2,785
Electrics	494
Large gas lamps	59
Total	13,395
Increase	278

LOCATION OF ELECTRICS.

	1885.	1886.
Brush, City proper	195	206
" Roxbury	38	47
" Dorchester	5	5
N. E. Weston, City proper	55	60
" South Boston	69	74
" Charlestown	26	38
Merchants', City proper	25	27
Citizens', East Boston	33	37
	446	494

The Newton Electric Light and Power Company lighted up its station Saturday evening, Jan. 15, as the first experimental using of the electric light. The result was successful and satisfactory. The station is located at Newtonville, and is a frame building two stories high, with a brick boiler-room. The building is 36 × 80 feet, large enough for growth of the plant, for the light promises to be exceedingly popular in Newton, as it has been in other places. The boiler is 150 horse-power, and the engine now in use is 70 horse-power. This week will occur the first exhibition of street lighting on Washington street, between Newton and West Newton, through Newtonville, a distance of two miles, about twenty lights being set at prominent street corners. The company will extend its line a mile further in this course from West Newton to Woodland Park Hotel, Auburndale; it will also run lights along Walnut street, Newtonville, between Washington street and the High School house, and at Newton along Centre street to Church street. Its dynamo is of forty-five arc light capacity, and about forty lights will be placed now. The company has no contract with the city at present, all its lighting being done gratis to show the citizens and city government the advantage of the white light over the yellow gleam of gas. The electric power will also be used as a motor for the street cars, which, it is expected, will be running in Newton before the year closes, a petition for a route for the electric railway being now before the City Council, and receiving its careful attention. The company has already received applications from individuals for private lighting, both by arc and incandescent lights, and suitable plants for both kinds will be put in, and the city canvassed for subscribers. W. I. B.

PROVIDENCE, R. I., Jan. 17, 1887.

The usual falling off in trade immediately after the commencement of the new year has hardly been noticed. Manufacturers report plenty of orders. The failure of several strikes that were intended to be test cases has in a great measure restored confidence, and supplies are now being ordered, as a general lock out for an indefinite period is impossible.

The Narragansett Hotel is receiving extensive decorations, which are shown to excellent advantage by the Edison electric light. The plant is pronounced one of their best installations.

Although the Corliss Engine Works have been apparently closed for the past eighteen months to permit of reorganization and construction of special tools, no date has yet been announced for their starting up.

Brown & Sharpe are very busy on their specialties, and are far behind their orders, working day and night to increase their production.

Harris-Corliss and the Providence Steam Engine Company report business excellent. The latter company have recently built many of their large improved engines, of which several have been located in Philadelphia.

The Rhode Island Locomotive Works have found considerable interest to be manifested in their new locomotive for the Stonington Railroad. It is to make the run from Providence to Groton, 62 miles, in 62 minutes. Hard coal will be used for fuel, and one charging of the furnace will suffice for the entire trip.

The Narragansett Electric Light Company, Thomson-Houston system, running its plant in connection with seven Armington & Sims engines, has exhausted its capacity. A new and larger station is contemplated. The rapid growth of the city demands it; so do the residents on popular avenues.

The Rhode Island Electric Light Company, United States system, Corliss engines, have placed many of their large incandescent Weston lamps in Infantry Hall, stores and hotels. They light part of the city with their arc system, and report the demand far in excess of their capacity.

The Armington & Sims Engine Company have had an extraordinary business during the past year. They have outgrown their present quarters and must have more room, as they have run their works three evenings per week for the past five months. Their average is 2,000 horse-power per month, including an export trade, which is large. Many important improvements have been made. Their engine has found its way into silver mines of the West and rolling mills, as its high speed and great power, with least possible weight, recommend it. Mountain transportation of large pieces of machinery is not only slow but expensive.

An excellent test for regulation, it is suggested, is the placing of a 100 horse-power engine to run in connection with a 50 horse-power water-wheel, the engine to govern all while furnishing power for arc and incandescent dynamos.

Terminal facilities are again agitated. Let us hope to result in relief to the city. If so, it will induce manufacturers to locate and increase its value. The prosperity of almost any place which must increase in wealth is in a great measure due to its small manufacturing interests whose profits remain in the community, and not to large corporations brought into existence by foreign capital on which dividends must be sent broadcast. R. E. N.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., Jan. 17, 1887.

All of our electrical supply people are apparently full of business, and orders are plentiful. New inventions and appliances are being constantly introduced. Among the new appliances may be mentioned that of Dr. A. P. Southwick, who has recommended to Governor Hill, of New York, the substitution of electricity for hanging in executions for capital crimes. His plan is to perfect an arm chair with electrical arms in which the condemned man would be seated, and at the proper moment receive a full electric charge through the metallic arms. This would pass straight through his body, and death would be instantaneous. A dynamo of 42 horse-power would be sufficient, he believes, to accomplish the work "with neatness and dispatch."

Partrick & Carter, No. 114 South Second street, are meeting with great success with their return or guest call system, which is composed of an annunciator for offices, as usual, but having a series of push buttons attached in the same case and under the dial of the annunciator; these pushes correspond with the numbers of rooms. In case of fire, two or three of these can be pushed at once, thus rapidly alarming the guests. They also combine with this a general fire alarm by which the bells in all the rooms of the house can be rung at once, or be rung separately, by simply turning a handle or crank.

The Otto Gas-Engine Company are selling numbers of their engines for electric lighting purposes. Many of our wealthy citizens are putting in small electric plants and are using Otto gas-engines for this purpose, the Otto engine being used in its simplest form with one cylinder only, so that any ordinary domestic about the house can attend to them. The lack of regularity in the engine is compensated by a small fly-wheel on the dynamo. The Otto engine is also being used for creating the currents for telegraphic purposes, more especially to stock reporting instruments. Mr. Bentley, of the Philadelphia Local, was the first to use the gas-engine for this purpose. The Western Union has followed him, placing a 15 horse-power engine in the Chicago office, which is giving entire satisfaction. They report sales on an increase and are constantly receiving inquiries and orders.

A. F. Fleischmann, 1812 Market street, has lately got out a new form of cautery battery, consisting of a series of cells, the elements arranged to be plunged at any desired depth in the exciting fluids by the use of porous cups similar to the Bunsen battery. The cauterizing electrodes are maintained at the desired temperature continuously for several hours, thereby avoiding the necessity of an assistant to agitate the elements so as to prevent polarization in such batteries which are now in general use for cauterizing purposes.

James W. Queen & Co., 924 Chestnut street, report that the trade is active in the electrical line, and that there is considerable demand for many of their specialties, among others the Toepler-Holtz electrical machine of their improved form, arranged for medical purposes. This is being extensively introduced in the offices of our best physicians as a supplement to the medical batteries so long and favorably known in the profession. There is a brisk demand among the electric light companies and practical electricians for the Carpentier ammeters and voltmeters, also for the new spring ammeters and voltmeters of Ayrton & Perry. The general opinion, both in practical use and tests, is that these last are very good and reliable instruments. They find that the German measuring apparatus has met with much favor in this country, being preferred in many cases to the English, especially the Wiedemann and Kohlrausch galvanometers and the Hartman & Braun rheostats.

Shaw & Geary, 53 and 55 North Seventh street, Philadelphia, are constantly introducing novelties and improvements in their line of business. They have enlarged their facilities and are making extensive preparations for bringing out their new electric annunciators, bells, gas-lighting apparatus, push and burglar alarm appliances. They are just about finishing a new cable road model car for E. J. Dougherty, of Tennessee marble fame, which

to go to Europe. They have as complete a shop and stock of tools as any one in this business in this city. They are getting up an incandescent meter to register the number of lights and the length of time burned, on the same plan as the gas meter works.

Thomas H. McCully makes a specialty of blue paper and prints. They reproduce every detail of machinery and plans of every description. His concern are meeting with great success with their permanent enlargements by electric light, and have increased their facilities for making enlargements for the trade, using two large electric lights of about 30,000 candle-power. They have a complete line of staples and everything needed by photographers.

Since the first of the year the Franklin Institute has been lighted throughout by the Westinghouse incandescent light, operated by the Keystone Light and Power Company, through their underground conduits. The first change noticed was that before they got accustomed to the different amount of heat needed, where gas is not used, they got the drawing school where 139 gas jets were cut off, so cold that the pupils had to go home.

A. F. Moore, 204 North Third street, have the new addition to their mill in complete running order, and are turning out from 700 to 800 pounds of copper wire of all sizes daily. They are very busy in all departments, and are doing a heavier business than ever before, and employing more hands.

An immense amount of interest has been shown in the coroner's jury investigation into the cause of the Temple Theatre fire, which occurred on Monday, Dec. 27, 1886. Wires have been run into the coroner's office and an incandescent light placed before the jury. The system of lighting used in the Temple was the incandescent light, the local agents of which are Walker & Kepler. Mr. Hicks, a former member of the firm, and an expert electrician, states that bad wiring in any system might cause a fire, but that it would be a matter of impossibility for any drapery or material not extraordinarily inflammable to be ignited by contact with one of the incandescent globes. Mr. Hicks had at one time an incandescent light burning for a hundred days under a mass of tissue paper, and light shavings, in an open fire grate, in order to show the light, but no fire occured within this time. Mr. Kepler demonstrated by putting his handkerchief on top of a globe, inside of which the carbon filament was burning, and after five minutes the handkerchief was removed without a singe. At the inquest the room was crowded with electricians and others. The city electrical inspector, Mr. McDevitt, who examines every electric wire in the city, before the building can be insured, is a thorough expert, and has seen more of the phenomena of electricity as applied to lighting purposes than any other man in the city, was present at the inquest and was eagerly watched by the gentlemen of the jury. He had affixed to the wall a board, from which protuded the sockets and globes of two large and twelve small incandescent lights, one switch governing the whole of them. Wm. F. Connor, the electrician of the theatre, testified that the wire ran through the moldings at the top of the booth, where the fire originated, and that from it a festoon of flexible cord brought the wire supplying the booth light to a globe and socket, suspended by a hook from the booth ceiling touching the drapery. When asked by the Coroner his opinion of the cause of the fire, he stated that he did not see how the electric light could have caused it. On being asked whether he did not know that a coat had been set on fire in the theatre by electric wires, Mr. Connor then stated that a year ago a workman employed in the theatre left his coat hanging on a globe, and had a hole burnt in it. Inspector McDevitt then testified that since the introduction of the incandescent light he had met 10 or 12 companies using different sized wires and different intensity of current. They are all supposed to use the safety plug in the socket of the lamp, which will fuse and extinguish the light at the moment that a stronger current than that which it is meant to bear is put upon it. The inspector then illustrated in various ways the manner in which short circuits occur and their effects in causing a fire. He showed especially how moisture would start an abnormal current leading to the charring of woodwork.

Electrician Connor was then recalled and swore that each of the ten lights in the eight booths of the theatre had a safety plug. Inspector McDevitt then turned on six of his lights, flashed a current on them, which melted the plugs and extinguished them. He stated to the jury that he was struck by the statement of the guard that steam had been coming up that morning, which might have caused the moisture necessary to establish a cross circuit between the wires. He next took up the subject of insulation and showed how inflammable the paraffine covering of the wires was which many companies are still using. The great trouble is, he said, that the demand for the light has been so great, that skilled workmen are scarce. On the foreman of the jury asking Mr. McDevitt if he thought the fire was caused by the electric lighting, the inspector replied that he should be very slow to say so, and upon being asked if he knew of anything else that could have caused it, he replied that he did not.

The jury inspected the ruins under the escort of the deputy coroner and Inspector McDevitt. Foreman McCleary picked up a length of wire, and a juryman, Prof. W. D. Marks, looked at a joint and said that it was not soldered. Electrician Connor explained that it was one of the up-stairs wires. The inspector said that unsoldered joints were a decided element of danger. Professor Marks inquired why the joints were not soldered. Electrician Connor explained that he had put in the wires in that state on request of George Singerly, Manager of the Musee, in order to have things ready for Christmas. He did not consider that he was taking any risks, although he would have soldered the joints if he had had time. He also testified that there were pumps under the Chamber of Horrors, and this, Inspector McDevitt testified when recalled, was a very dangerous element, through the condensation of moisture. He thought, however, that this danger would have existed whether or not the wires were soldered. J. C. Walker, one of the local agents of the Edison Company, did not consider the unsoldered joints a good piece of work. Manager Brotherton said that he knew Connor was hurried with his work, but did not think that any danger was thereby incurred. He testified that the building was heated by steam, and Charles Ormsby, a steam fitter of the place, said he had a stream of water ready within three minutes after the fire broke out. The jury had not yet arrived at any conclusion, and time was given them until the inquest resumed.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Jan. 15, 1887.

Mr. Henry Olds has been elected President of the Ft. Wayne Jenney Electric Light Company in place of O. A. Simons, lately deceased. Mr. R. T. McDonald still continues as general manager. The capital stock of the company has been increased to half a million dollars.

The Western Electric Company have lately increased the Concordia, Kan., plant from 30 to 60 lights. Other late orders are for Washington, Kan., a plant of 30 lights; for Steubenville, O., 90 lights, and for Tampa, Fla., 30 lights. Some time ago the Caspar Lumber Company, of Caspar, Cal., purchased an electric light plant of the Western Electric pattern, with which they have been ever since lighting their saw-mills. They now write that not only is the light giving them satisfaction in other ways, but that it is effecting a saving in the expense of lighting their mills of from $200 to $300 a year. This speaks well for electric lighting in general and the Western Electric system in particular. Readers of this column have no doubt noticed the fact, which is rapidly becoming more apparent, that a great many of the Western Electric Company's lights are going into use in different parts of the country, and that they give entire satisfaction in every case.

The Van Depoele Company are sending two more motors for their electric road at Detroit and additional motors for their road at Scranton, Pa.

Five hundred incandescent lights are going into Fowler Bros.' packing establishment at the Chicago stockyards, and the same number into Swift's packing houses.

The Illinois Secretary of State has issued a license to J. I. Veeder, W. Rossiter and William Rheem to incorporate the Railway Electric Car Lighting Company with a capital of $100,000. In connection with the above I will mention that one of our local dailies, in an article commenting on the Tiffin, Ohio, catastrophe, strongly advocates the lighting of railroad cars by electricity. The paper in question thinks, what every electrician knows, that this could easily be done, and in consequence there would be much less liability of the cars catching fire in case of accident.

Racine, Wis., talks of owning and operating its own electric light plant, and figures out that by so doing the city would effect a considerable saving each year.

A Mather incandescent machine and lamps can be seen in operation at 117-119 Lake street, Chicago.

In Indianapolis there are complaints on all sides over the workings of the present system, which was adopted by the telephone company something like a year ago, whereby each subscriber was made an agent of the company, and a charge of five cents was made against the telephone making the call. Under this arrangement the rentals run from nothing up to ten or twelve dollars a month, though very few reach the latter figure. The company claim the average barely pays the royalty on instruments. Under the existing state of things, the company is not allowed to make repairs to lines or make new connections for instruments. In case the present law is changed and the company allowed to do business as before (and it is to be hoped it will during this session of the Legislature), a considerable outlay will be necessary to bring the lines up to the proper working condition, as no work has been done on them for more than a year.

Mr. D. S. Foote, Manager of the American Electric Manufacturing Company, 117-119 Lake street, Chicago, reports business good and his shop pushed to its utmost capacity. Mr. Foote has handsome offices and a very complete shop at the above number.

Several of Dakota's pushing young towns are contemplating the introduction of the electric light.

Just before the close of the afternoon session of the Board of Trade here on Jan. 11, members were startled by a terrific explosion. An instant later a piece of iron weighing probably eight or ten pounds crashed through one of the plate-glass windows in the front of the building and fell on the floor of the hall. Thoughts of bombs and Anarchists flitted through the minds of the excited members, and business in the wheat pit was unceremoniously suspended. On investigation it was found that an explosion had occurred in the underground conduit in which the wires of the Western Union Telegraph Company are laid, and the cover to the manhole directly in front of the building had been blown to fragments. It was one of these fragments which, after flying a distance of seventy-five feet, created such consternation on 'Change. The only person in the hall who received an injury was slightly cut on the forehead by a fragment of the flying glass. A leak in one of the gas-pipes under the sidewalk had filled the conduit with gas, and a lineman who went into the basement with a light to look for a broken wire did the mischief. The eye-brows and whiskers of the lineman were severely scorched, but no serious damage was done.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes us the following telephone stock quotations:

Bell of Mo.	$157@$160
Central Union	48@ 49
Chicago	375@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	16@ 19
Michigan	71@ 73
Rocky Mountain Bell	40@ 45
United	18@ 20
Wisconsin	104@ 106

W. A. K.

OMAHA, Neb., Jan. 11, 1887.

A very interesting review of the growth of Omaha is given by the local *Bee*, of which Mr. Rosewater, an old telegrapher, is editor. It includes several matters of electrical interest. The main points are quoted below:

Omaha has always been the "central switch-board" of the Western Union Telegraph Company. Through it passes or is relayed all the electrical news of the far West and the Pacific coast, and from those sections, as well as the important telegraphic news from and to China and Japan. The district of which this city is the headquarters embraces all of Nebraska, Colorado, Wyoming, Utah, part of Montana and part of Kansas. In that district are 1,000 operators, forty-five clerks, twenty-eight foremen, ninety-eight messengers and two battery men. There are 10,753 miles of poles and 26,625 miles of wire. The total number of messages sent from and received at Omaha from Jan. 1 to Dec. 13, 1886, was 1,821,631; total number relayed during the same period, 1,093,059. There are fifty-eight operators at the main office in this city, sixteen clerks and one battery man, and six operators in branch offices in the city. There are forty-five circuits out of the city and 3,000 cells of battery in use. The monthly pay-roll of the Omaha office is $5,200, while the actual disbursements therefrom for general expenses run from $10,000 to $15,000 per month. The receipts of 1886 have been 20 per cent. greater than those of 1885, and the increase of work fully 35 per cent. greater.

The whole district known as the "Third" is under the management of Colonel J. J. Dickey, one of the best known telegraphers in the country. Many improvements were made during the year, entailing large expenditures. Principal among these may be mentioned the stringing of a new copper wire from Brownville to Denver, a distance of 435 miles; one from Omaha to Cheyenne, 516 miles; one from Chicago to Omaha, 498 miles, and one from Cheyenne to Denver, 106 miles, making a grand total of 1,559 miles.

The Pacific Telegraph Company opened its office in Omaha in November, 1885, and business has increased ever since, the amount being 60 per cent. more last month than it was during the corresponding month of 1885. This is a good showing, considering the fact that the company has only one line in this State, reaching to Marysville, Kansas, via Lincoln, Nebraska; but the contract is now let for the construction of 16,000 miles of wire west of Omaha and leading into this city. Work will commence as soon as the season permits. The Omaha office is in charge of J. M. Maddox, and he has 13 assistants, including operators, linemen, etc. The monthly pay roll is $550.

The officers of the District Telegraph Company are: M. H. Goble, President; L. H. Korty, Vice-President; L. M. Rheem, Secretary and Treasurer, and James Donnelly, Jr., Superintendent. It has a paid up capital of $50,000. The work of 1886 was more than double that of 1885. The expenses of the company for the last year have averaged $1,500 per month; it has now 650 of its own patent call boxes in different business places and residences, twenty-five miles of independent telegraph wire, seven express wagons, and employment is given to forty boys and twelve men, the former neatly uniformed. During the last year the following calls have been answered:

Messenger calls	86,980
Cab calls	24,252
Express wagons	24,660
Total	135,892

During the last few months a number of improvements have been made in the system. The most prominent is the introduction of the McCulloh system of district telegraphs, of which THE ELECTRICAL WORLD gave recently a very full description. The company is also introducing night watchmen's signal service boxes.

The Nebraska Telephone Company has as officers S. H. H. Clark, President; J. J. Dickey, Vice-President; L. H. Korty, Secretary and Treasurer; V. P. Musselman, Cashier; Flemon Drake, General Manager; S. H. H. Clark, J. J. Dickey, L. H. Korty, E. M. Morsman, Flemon Drake, M. H. Goble and J. W. Rodefer, all of Omaha, and John R. Clark, Lincoln, Neb., and George Albree, Boston, Board of Directors. The company was organized July 1, 1882. It has a paid up capital of $600,000, with the privilege of increasing it to $700,000. It has 580 miles of wire connecting points outside of Omaha. There are forty-five of the company's offices in Nebraska, and fifty-one in connection with the Union Telephone Company's lines in Iowa, making a total of ninety-one offices. The total number of employés is 155, of whom 43 are connected directly with the Omaha office, 14 of these being operators, and the last quarterly pay roll was $7,040.49, including messenger service. The number of miles of wire in Omaha in 1886 was 596, to which 100 miles were added during the last year. The number of telephones in use in Omaha is 891, and altogether throughout the territory covered by the company 2,700. The expenses of the company averaged in 1885 about $39 per instrument for the entire twelve months. The average for 1886 will be somewhat larger. The company has decided to put up in this city nothing less than 45-foot poles. Last year forty-one 60-foot poles were erected. The receipts for nine months of last year largely exceeded the receipts for the entire twelve months of 1885, the increase being fully 30 per cent. over any previous year. The average number of calls answered every twenty-four hours during the last year was 11,000, and the day before Thanksgiving 15,000 were answered. There are seven public telephone offices in Omaha, nine outside offices were added in 1886, and eleven more will be added at once. The longest talking circuit is to Blue Springs, Neb., a distance of 123 miles. As soon as the Ramge building is finished, the company's headquarters will be moved there, and a complete change for the better will be made in all branches of the system. Besides having large and convenient operating, business, electrical and other necessary rooms, a new and improved switch-board and accompanying apparatus will be put in which will cost $19,000. Every subscriber will have a new and improved instrument to replace that now in use; two-thirds of all the lines in the business portion of the city will be rebuilt; the wires will be placed in cables of 100 wires each, and a radical betterment of the system will take place, the estimated cost of which will be over $33,000. In addition a new line will be built to Ashland, Nebraska, and other minor improvements made.

The Thomson-Houston Company succeeded the Sperry Light and Motor Company in 1885, which itself was the successor of the Northwestern Electric Light and Power Company, and after hard work and changes of management success has been achieved. The officers of the company are: J. C. Regan, President; J. E. Riley, Secretary and Treasurer, and G. J. Melms, Manager and Superintendent. The capital of the company is $100,000, eight men are employed in the works, 225 lights are now in operation, the power is furnished by a 250 horse-power Corliss engine and three Westinghouse high-speed engines. During the present month a station of 500 arc lights and one of 2,000 incandescent lights will be established. Electric motors for small factories will also be in readiness, which will be of great benefit to industrial works founded on moderate capital and will undoubtedly add to the manufactories of the city. This company is now using 160

tons of coal per month and 300,000 gallons of water are evaporated in its boilers during a similar period. The business of 1886 has exceeded that of all former years and promises well for the future.

The Omaha Illuminating Company commenced business November 16, having leased the poles and plant of the defunct Northwestern Light and Power Company. The capital of the company is $20,000, and its officers are P. C. Himebaugh, president; R. W. Breckenridge, vice-president; Frank Warren, secretary and treasurer; J. D. Morse, superintendent; H. T. Clarke. C. C. Warren, P. C. Himebaugh, R. W. Breckenridge and Frank Warren, directors. Seven dynamos are now used, the power is furnished by a 275 horse power Corliss engine at the Woodman Linseed Oil Works, eighty arc lights are in use, seven men are regularly employed and the monthly running expenses are $1,000. The company intends to double its capacity at once. It has just introduced the incandescent lamps of the United States Electric Lighting Company, and preparations have been made to distribute 12,000 of these lights in Omaha.

An Edison company with $1,000,000 capital was also organized here last year.

The Midland Electric Company, established in 1884, reports its business as 75 per cent. better than the previous year. The paid up capital of the company is $50,000, and its officers are: J. J. Dickey, president; Flemon Drake, vice-president; H. J. Wells, secretary and manager; L. H. Korty, treasurer; Israel Lovett, superintendent. Eleven men are constantly employed, and the expenses of the company during the last year were $10,000. It does a general fitting, supply and equipment business.

The Fire Department reports having 43 alarm boxes in use.

THE TELEGRAPH.

Wrecked by Petroleum.—The telegraph office at Geneva, Switzerland, has been wrecked by an explosion of petroleum.

The Cable Pool.—It is rumored that in its effort to withdraw from the cable pool, the French Company will have the support of the French government, the new minister of Posts and Telegraphs declaring that the charter prohibits the company from entering a pool or other combination. It is also reported that the French Company will cut the cut rates to the quick.

The Commercial Mortgage.—There has been filed as a renewal in the Register's office the Commercial Cable Company's mortgage to Ernest W. Siemens, of Berlin, and Johann C. Ludwig, of Westminster, securing the debentures amounting to $3,000,000, which the company issued about a year ago. A certain portion of the debentures, chosen by lot, are to be retired semi-annually, beginning Jan. 15, 1887, and the filing of the mortgage was part of this transaction.

"The Foremost Exponent."—THE ELECTRICAL WORLD, proud of itself and of its position as the foremost exponent of a great industry, gives vent to that pride in a neat little pamphlet, outlining the origin, growth and development of that journal. Like the WORLD itself, the book is handsomely printed and tastefully illustrated. Cuts, representing the various departments, convey a very correct idea of the suite of apartments occupied by the paper in the new Potter building, the tallest of the tall office structures in New York. We think we see an ulterior reason in the WORLD'S putting itself at this high altitude; like our own Ben drawing the lightning flash with his silken kite and key, following out the fundamental principles of the science, it puts itself into a position for future observation.—*Phila. Progressive Age.*

His Name is Wade.—The general superintendent of the great Wabash railway system some years ago was a common telegraph operator in Delphi, Ind., earning barely enough to pay his board and clothing. But he made a study of the railroad business as opportunity presented in that obscure little town. By and by the opportunity came for making a suggestion to the managers. It was a good one. Railway managers are constantly on the lookout for men who show their competency. No men in the world are quicker to recognize and reward fidelity and ability. This operator was promoted to a more responsible post. Here his whole time was given to mastering his duties and bettering the service. So he was promoted again and again, until a year ago he was made the general superintendent of the vast system, and with a salary commensurate with his responsible duties. His name is Wade.—*Boston Journal of Commerce.*

Pacific Slope Weather Service.—A bill, which is to be presented to the California Legislature, provides for a central office in San Francisco for meteorological observations, to be called the California State Weather Service. The Board of Control will be composed of the President of the State University, the President of the California Academy of Sciences, and the Signal Officer of the Pacific Coast, providing the consent of the Chief Signal Officer of the Army to such service can be secured. The Board of Control shall appoint a competent director of the State Weather Service, and shall receive his monthly and annual reports. Volunteer weather stations shall be established by the director at such points in the State as are most suitable, receiving reports therefrom and disseminating the results obtained by all possible means. Special attention will be given to transmitting to all towns in the State information concerning the approach of storms or other information received. Provision is also made for the establishment of stations and the purchase of instruments.

Fight Over the Tickers.—The suit of the Commercial Telegram Company for a perpetual injunction restraining the Stock Exchange from expelling it from the privilege of collecting information on the floor of the Exchange and sending it out on its "tickers" is on trial before Judge Ingraham, in the Supreme Court, Special Term. The Commercial Telegram Company claims to have a license, unlimited as to duration of time, to collect within the Exchange the information it needs, and that the Exchange proposes to arbitrarily expel it for the advantage of its rival, the Gold and Stock Telegraph Company, and to thus cut off the great source of its business and revenue. The Stock Exchange insists that it has an absolute right to determine how and by whom its building shall be used. Roscoe Conkling, James E. Chandler, and George Putnam Smith appear for the Commercial Telegram Company, and James C. Carter, L. Cass Ledyard, John F. Dillon, and Wager Swayne for the Exchange and Western Union and Gold Stock companies.

The Snow-Alley Case, as to a big block of Postal stock, is on again, motion for a new trial having been made. Newly discovered evidence was presented to the court by Counsel H. M. Knowlton in several affidavits. One was that of Thomas Wallace, agent and treasurer of the firm of Wallace & Sons, the corporation engaged in the manufacture of telegraph wires. The affidavit states that he remembers the contract between the corporation and the Postal Telegraph Co.; that he has been informed that Chester Snow testified in the last trial that he (Snow) had a secret agreement or a private understanding with Wallace & Sons to the effect that, if the balance was not paid in said amount, the $90,000 so paid when forfeited should be given to said Snow; that it is not true that said Snow had any secret agreement or understanding with Wallace & Sons to that effect. No such contract, or agreement, or understanding, was ever made or had between said Wallace & Sons and said Snow, the fact being that the $90,000, had the contract not been complied with, would have been forfeited to Wallace & Sons.

The Montreal Company.—A special dispatch of Jan. 13 from Montreal says: The annual meeting of the Montreal Telegraph Company, which was held this afternoon, was a good deal tamer than had been expected. A feature of the meeting was that the annual report was presented without the list of shareholders. This is the first time this has taken place for seven or eight years. Various interpretations are put on this. One is that 23,800 shares are held on the street on margin. In 1884 the annual report drew special attention to the fact that there were only 3,700 shares held on speculation. Besides the resolutions already published it was resolved "that the incoming directors be authorized to take such steps as they may deem necessary in the interest of the company to enforce the terms of the agreement with the Great Northwestern Telegraph Company." Messrs. John Crawford and John Stirling retired from the directorate, thereby complicating the situation, as it was believed that an arrangement could be made through them with the Great Western Company. Mr. Crawford took occasion to deny the report that he had been advised by Mr. Erastus Wiman to sell $100,000 of the stock he held in the Montreal Company. He had sold the stock simply because he did not think it prudent to carry such a large amount. The directors were blamed for not notifying the public sooner that the dividend would not be paid. The new directors elected were Messrs. A. Allan, Hector McKenzie, W. Cassils, Jesse Joseph and William Wainwright. At a subsequent meeting of the board Mr. Andrew Allan was re-elected President.

THE TELEPHONE.

Underground in Buffalo.—The Bell Telephone Company of Buffalo has asked permission to build underground conduits in that city for its wires.

Poles at East Orange, N. J.—The Vice-Chancellor of New Jersey has handed down a decision against the Telephone Company as regards the disputed poles on Park avenue at East Orange.

Bell Income.—A Dow, Jones & Co. special from Boston says: The American Bell Telephone Company's net receipts for 1886, from all sources, were $1,947,000, against $1,793,000 for 1885, an increase of $154,000. The income for 1886 is 20 per cent. on the dividend earning capital of $9,700,000. Rentals from sub-companies decreased about $200,000. The dividend receipts from sub-companies increased nearly $250,000 over 1885, and amounted to about $844,000.

The Massachusetts Suit.—The government bill in the suit against the American Bell Company in Massachusetts was filed at Boston on Jan. 13. The defendants have till the first Monday in March to file an answer, and the beginning of the trial may be reached five or six weeks later. The bill is practically the same as that filed at Columbus. The chief point of novelty is alleged invalidity because Bell did not file a model, in compliance with patent-office rules.

New York Legislation.—Among the bills introduced in the New York Legislature are the following affecting telephone interests: By Mr. Cullen—Fixing telephone charges at $6.50 per month in cities having over 500,000 inhabitants; at $3.75 in cities having from 100,000 to 500,000 inhabitants, and at $2.75 in cities having less than 100,000 inhabitants. By Mr. Murphy—Prohibiting telephone companies in the State from charging more than $3.50 per month rental for one telephone, or more than $2.50 where two or more telephones are rented by one person; also fixing the maximum switching charge between two cities or villages at 15 cents for the first five minutes, and 5 cents for each additional five. Discrimination among tenants of telephones is also prohibited. By Mr. Reilly—Providing that in New York and Brooklyn telephone charges shall not exceed $5 per month.

THE ELECTRIC LIGHT.

Oxford, Pa.—The electric light plant is to be enlarged.

Maine.—Electric lights have been put in the Kezar Falls woolen mill.

Asheville, N. C.—The new Asheville Company has a capital stock of $15,000.

Manchester, Ia., is to have electric lights. Mr. E. T. Keim, Dubuque, Ia., is interested.

Staten Island Ferryboats.—Three new Staten Island ferryboats are to be lit by electricity.

Railway Lighting.—The Julien accumulators are being used with success in lighting cars on the Boston & Albany line.

Carbons.—The incorporation is announced of the Globe Carbon Company, Cleveland. It has been at work for some time past.

Westchester County, N. Y.—The Board of Supervisors of the county have decided to light the Court House by electricity.

Edison Dividend.—The Edison Electric Illuminating Company, of this city, has declared a regular quarterly dividend of 1 per cent.

Watervliet, N. Y.—The Watervliet Electric Light Company, incorporated by T. Knowlson and others, has a capital stock of $50,000.

Hillsdale, Mich.—The Hillsdale Electric Light Company has been incorporated by H. A. Branch and others with a capital stock of $15,000.

Litchfield, Ill.—The Litchfield Electric Light & Power Company has been incorporated by H. H. Beech and others with a capital stock of $15,000.

Providence, R. I.—The Narragansett Electric Light Company, Providence, R. I., has commenced paying quarterly dividends of 2 per cent.

Boston, Mass.—The Edison Company has asked permission to bury wires in Park street and in Beacon street between Tremont and Charles street.

Whitewater, Wis.—The Whitewater Electric Light Company has been incorporated by O. P. Posey and others, with a capital stock of $25,000.

Greenfield, Mass.—The Greenfield Electric Light and Power Company incorporated by J. H. Sanderson and others has a capital stock of $10,000.

Mount Vernon, N. Y.—The electric lights at Mount Vernon are reported a splendid success, and on Feb. 1 the trustees of the place will dispense with gas.

Winchester, Va.—Steps are being actively taken to form the lighting company of which mention was made a week or two ago. Mr. E. Y. Henkle is interested.

Jefferson, Mo.—The Wagner-Fisher Electric Light and Power Company has been incorporated by W. W. Wagner and others, with a capital stock of $18,000.

Cleveland, O.—The electric lighting of the viaduct is nearly complete. The forty-seven gas lamps withdrawn are replaced by seven Brush lights suspended over the middle of the roadway.

Harlem, N. Y.—The Jarvis Engineering Company, Boston, has received the order to set three Zell sectional boilers with the Jarvis patent boiler setting, from the Harlem Illuminating Company, Harlem, N. Y.

Lighting an Office Building.—The Electrical Accumulator Company is fitting up Edison lights in the building 42-44 Broadway, and will run the lights off a set of its accumulators standing in its office.

A Light, Heat and Power Company.—The New York Safety Light, Heat and Power Company, of New York, has been incorporated with a capital stock of $250,000, by C. H. Jackson of Pittsburgh, and others.

A New Parent Company.—The Farmer Electric Manufacturing Company, of Portland, Me., has been incorporated with a capital stock of $1,000,000. The President is no other than the veteran Prof. Moses G. Farmer.

Amesbury, Mass.—The Electric Light & Patent Flooring Company is running 20 street lights at the present time, and expects to make a city contract in the spring for 40 lights of 1200 c. p. It is soon to put in a 45-lighter Thomson-Houston, replacing a 30-lighter.

Biddeford, Me.—The Jarvis Company has received the contract from the Traders Electric Light Company, Biddeford, for a 150 horse-power tubular boiler, a set of Sheffield grates, etc. The boiler will be set with the Jarvis boiler setting and burn screenings for fuel.

"E. P. S." Accumulators.—During the last 50 days the E. P. S. Company, of London, Eng., has received and executed orders for accumulators sufficient to supply 5,150 16 candle-power lamps having a capacity of 3,390,000 watt-hours, or 4,543 h. p hours. These are exclusive of orders for a large number of cells suitable for motive power and other purposes.

A Strange Accident.—A fire, starting, it would appear, in the extensive system of belting, occurred at the station of the Rhode Island Electric Lighting Company, at Providence, R. I., at 4 A. M., on Jan. 15. Considerable damage was done in the station and building, and about 80 city lights were thrown temporarily out of service. The engineer was suffocated on the spot and the fireman was fatally burned.

The Boston Edison Company.—The Edison Illuminating Company, Boston, Mass., have commenced paying monthly dividends of one per cent. The Boston station shows, it is said, the best profit out of sixty-eight Edison stations in this country. It was constructed by the Jarvis Engineering Co., of Boston, and speaks well for their system of using high-speed engines and burning screenings for fuel under boilers set with the Jarvis boiler setting.

APPLICATIONS OF POWER.

Bavaria.—An electric railway has been opened for public use at Schwabrig, Bavaria.

Orange, N. J.—The Daft Company has secured the contract for building the new electric railway at Orange.

Cincinnati, O.—The Fairmount Improvement Association is considering the construction of an electric road to Cheviot.

Los Angeles, Cal.—Col. Howland, of the new Daft road, has in view the distribution of power by means of electric motors from ½ h. p. up to 10 h. p.

The Van Depoele System.—The Van Depoele Company has issued a new and handsome catalogue, giving descriptions, details and cuts of its electric railway system, and views of several of its roads now in successful operation.

The Ries System.—The announcement is made of the incorporation of the Ries Electric Railway Manufacturing Company, Portland, Me., with a capital stock of $1,000,000. The president of the company is Mr. R. F. Straine, Sr., of Boston.

A Public Spirited Mayor.—Mayor Ripple, of Scranton, Pa., in his annual message, thus alludes to the electric railway now in operation there. "It may do here to mention the advent of a third railway, one of entirely different construction and motive power. The Suburban Electric Railroad, conceived in much doubt and with many misgivings, has blossomed out into a grand success, in which each Scrantonian feels a pardonable pride. It is not alone that it is a new thing, but that it is a good thing, and I take this means of expressing my personal gratification and pride that our public spirited citizens have had the nerve to undertake and carry out a project so creditable to themselves and the progressive spirit of our city."

Electric Railway for Buda-Pesth.—Mention was made a short time ago, of a project for the erection of an electrical railway in the Hungarian capital. Since then, *Industries* states, the undertaking has progressed a step further, and seems almost secured. On the initiative of the Board of Works, a commission inspected the proposed line, and reported favorably as regards the general scheme. As regards the vested interest of private parties which might be affected by this line, the commission is of opinion that the contractor should come to terms without the aid of the Town Council; but the latter promises to further, as much as possible, this undertaking. The concession, which will be given by the Board of Works, has not yet been granted, but is shortly expected. The contractors will probably be Messrs. Lindheim & Co., of Vienna; Siemens & Halske, of Berlin; and Moriz Balázs, of Buda-Pesth.

PERSONALS.

Mr. Henry Edmunds has become a partner in the leading English firm of Walter T. Glover & Co., and will have the conduct of the London business at No. 10 Hatton Garden, E. C. Mr. Edmunds is well known in connection with the introduction into Great Britain of the Farmer-Wallace, Brush and Hochhausen systems of electric lighting, and into this country of the Swan lamp and the Vitrite Company's patents.

Mr. Henry M. Cleveland, of Connecticut, recently President of the Schuyler Electric Light Company, has become the senior partner of a new firm under the name of Cleveland, Whitney & Co., which will transact a general banking and brokerage business at No. 7 Exchange Place, Boston. Mr. Whitney is a well-known Boston banker and broker, while Mr. Cleveland is one of the best-known business men of Connecticut. The new firm begins business under very favorable auspices, and with every prospect of speedily making a place for itself on the street.

Major D. P. Heap says: "I have been somewhat annoyed by the absurd statements attributed to me about the stability of the Statue of Liberty which have appeared in recent newspapers. They grew out of a conversation I had with a reporter, in the course of which I told him that I had recently visited the statue, and that I found some vibration in the arm, as was to be expected, and that therefore, in my opinion, visitors should not be allowed to climb into the torch, as their extra weight would necessarily increase the vibrations and in time might weaken the supports, the same as an iron railroad bridge is weakened by the continual passage of heavy trains. All this talk about corrosion, the dropping off of the arm, etc., is simply rot. I have every confidence in the stability of the statue proper, and I trust and believe that it will be a long time before the arm will develop any weakness; but it stands to reason that the less strain it is subjected to the longer it will last. Therefore, I say again, keep visitors out of the torch. This will be no special hardship to the visitors, as they can go to the head and have a splendid view through the openings in the crown. Besides, it may prevent some idiot from committing a sensational suicide."

MISCELLANEOUS NOTES.

Nickel-Plated Cooking Vessels.—An order has been issued in Lower Austria forbidding manufaccurers and tradesmen to sell nickel-plated cooking vessels. It is stated that vinegar and other acid substances dissolve nickel; and that this, in portions of one-seventh of a grain, causes vomiting, and is even more poisonous than copper.

Covering Soldered Joints.—When copper is soldered, and the solder is to be colored like the surrounding copper, this can be done by moistening the solder with a saturated solution of sulphate of copper, and then touching the solder with an iron or steel wire. A thin skin of copper is precipitated, which can be thickened by repeating the process several times. If a brass color is desired a saturated solution of one part of sulphate of zinc and two parts of sulphate of copper is used on the previously coppered solder, and the latter rubbed with a zinc wire. To gild the soldered spot, it is first coated with copper in the manner indicated above, and then with gum or isinglass and powdered with bronze powder. This surface is obtained which, after drying, can be very brightly polished.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

January 19, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	27	35
Am. Tel. & Cable	73	75
Cen. & So. Am.	90	100
*Com. Tel		
*Gold & Stock	90	
*Inter. Ocean Tel.	85	
N. Y. Mutual	72	74
Pac. & Atl.	47	54
*Postal T. & C.	30	35
South. & Atl.	60	
W. U. Tel.	74¼	74⅜
W. U. Scrip	65	
W. U. Bonds		121½
Mut. U. Bonds	84¾	85
TELEPHONE.		
Am. Bell	200	201
Am. Speaking	112	120
Erie	27½	28
*Hudson River	58	

TELEPHONE.	Bid.	Asked
Mexican	1⅛	1½
*N. Y. & N. J.	87½	93½
N. Y. & Pa.		
New England	43½	44
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric		
*Brush		
*Brush Ill		
*Consolidated		
*Daft		
*Edison	125	135
*Edison Ill	97½	100
*Edison Isolated		
*United States	35	
*U. S. Ill	100⅛	110
MOTOR.		
*Daft		
*Sprague	100	

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

Armington & Sims Engines.—The Armington & Sims Engine Company sold last year over 200 high-speed engines, and the Jarvis Engineering Company, their New England agents, sold over one-quarter of this number. The workmanship of this engine is made as perfect as possible. They use cast steel shafts that alone cost twenty-seven cents a pound.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

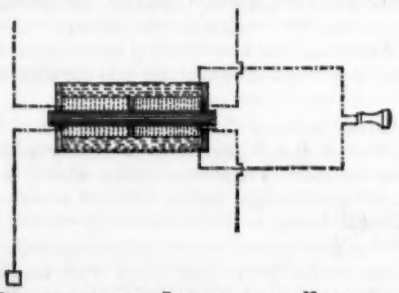
PATENTS DATED JAN. 4, 1887.

355,330. Underground Wire and Steam Street Conduit; S. D. Locke, Hoosick Falls, N. Y. Application filed July 28, 1886. Several different compartments are provided for the electric light, telegraph and telephone wires and steam pipes. The conduits are provided with brackets for supporting the wires and pipes, and an improved covering for the whole structure is described.

355,363. Mechanical Telephone; T. H. Weinhaus, St. Cloud, Minn. Application filed July 6, 1886. The diaphragm consists of two flexible discs placed in juxtaposition, to the centre of which is secured the telephone wire. A sounding-board is placed at a slight distance back of the diaphragm, thus providing a sounding chamber. The whole arrangement is adapted to increase the volume and quality of sound transmitted and received.

355,380. Coupling for Electric Wires; G. A. Carpenter, Providence, R. I. Application filed Oct. 15, 1886. The coupling consists of a pair of conical sleeves which inclose the ends of the wire. As they are screwed or driven toward each other they force a wedge between the split ends of each wire, which causes the split portions to open and fill the conical space inside the sleeve and prevent their pulling out.

355,382. Electrical Indicator; W. H. Chapman and B.



355,420. PREVENTION OF INDUCTION IN ELECTRIC CIRCUIT.

C. Donahue, Portland, Me. Application filed April 8, 1886. The object of the invention is to enable a person at one place to indicate to persons at another place one of a series of names through the medium of an electric wire. The apparatus consists of a generator of electricity, to be operated by hand whenever a signal is to be conveyed, and a receiver or indicator, by which the particular name is indicated.

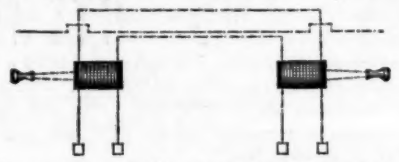
(1) 355,383. Telephone Signal; (2) 355,384. Electric Alarm; C. E. Chinnock, Brooklyn, N. Y. Applications filed respectively Jan. 6, 1886, and Jan. 31, 1885. (1). This invention involves means whereby two distinct signals may be given through the employment of two batteries or two different pole-changers to a subscriber by the operator at the central office, for the purpose of indicating to the subscriber, without causing the latter to step to the telephone and listen at the receiver, either that all necessary connections have been made or that the necessary connections could not be made to afford him the desired communication. (2). This device is for giving an alarm at railway or elevator stations to indicate when the station gate or door has not been closed, or when the car or train has not stopped at the proper position for the exit or entrance of passengers.

355,400. Mast-Arm for Electric Lamps; T. B. Keeler, Danbury, Conn. Application filed April 23, 1886. The device comprises a rigid arm and a track pivoted at its outer end, a weight and two cords extending upward therefrom, one of which is attached to a pulley from which the lamp is suspended and which is adapted to travel upon the track, the other passing to the inner end of the track, whereby, when the weight is raised, the inner end of the track is permitted to fall and the lamp to move downward thereon.

355,412. Electrolyte and Depolarizer for Galvanic Batteries; W. C. Quinby, San Francisco, Cal. Application filed March 16, 1886. For description see page 42 this issue.

355,420. Prevention of Induction in Electric Circuits; John O. Stockwell, Burlington, Kansas. Application filed March 18, 1886. The inventor designs to overcome the ill effects of induced currents generated by adjacent electric light and power currents in order that telephonic communication may be carried on uninterruptedly. The electrical connections are shown in the illustrations. The elements comprising the invention are: Two stations, two telephones, one at each station, two main lines, two inductoriums, with three coils to each inductorium, the outeror primary coil being in circuit with the telephone, and the inner or secondary coils being separately in circuit with the main lines, and wound in opposite directions. Each main line has an earth connection at each station. See illustration.

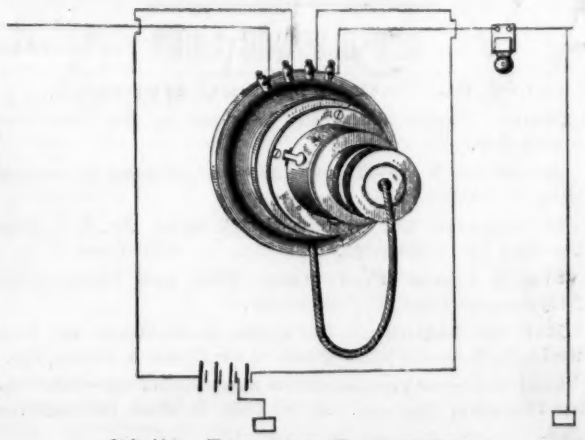
(1) 355,423. Terminal for Electric Conductors; (2) 355,424. Telephone Receiver; (3) 355,425. Central



355,420. PREVENTION OF INDUCTION IN ELECTRIC CIRCUITS.

Office Telephone Switch-Board; (4) 355,426. Telephone Transmitter. F. C. Watkins, Philadelphia, Pa., Assignor by mesne assignments to the United States Krotophone Company, of New York, N. Y. Applications filed respectively April 21, 27, 21 and 27, 1886. (1). A sheet metal strip, having perforations at each end with a neck between them, is provided. The strip is to be doubled over and the wire clamped between, the doubled over parts being held securely together by a screw which passes through both perforations into a base. (2). A receiver composed of a diaphragm, and a soft-iron core, surrounded by a helix of iron wire, the helix being in turn surrounded by a secondary helix of copper wire, the two helices being insulated from each other. (3). This is a switch-board provided with a series of vertical metallic strips, each one of which is connected to an individual line through an annunciator, and having a series of weighted levers, and a series of longitudinal metallic strips arranged across the back of the board, whereby a weight attached to the hooked end of one of the levers will connect it with the corresponding strip on the back. (4). The object of this invention is to simplify telephonic communication, so that all the subscriber has to do is to detach his receiver from the transmitter when he desires to talk, and to replace it when he is through. See illustration.

355,431. Telegraph Receiving Instrument; Wm. Arthur, Gainesville, Fla. Application filed July 24, 1885. For description see page 41 this issue.



355,426. TELEPHONE TRANSMITTER.

355,434. Electric Clock Winding Attachment; J. Broich and A. E. G. Luebke, Brooklyn, N. Y. Application filed Sept. 3, 1886. An electric motor is provided in combination with a clock. The circuit is automatically closed once each hour and each time the clock spring is wound up.

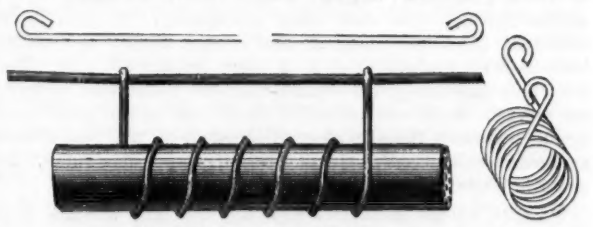
355,443. Method of Suspending Electric Lights; H. F. Edwards, Providence, R. I., Assignor of one-half to the American Electrical Works. Application filed May 7, 1886. The invention is a structure for suspending electric lights across streets or squares, and consists of a truss adapted to be secured at each end to buildings or poles, and provided with a covered track for the reception of a carriage for the electric lamp. Means are also provided for moving the lamp along the track when necessary.

355,446. Safety Circuit for Electric Lights; E. T. Greenfield, New York, N. Y., Assignor to himself and Sigmund Bergmann, same place. Application filed July 3, 1886. For description see page 43 this issue.

(1) 355,468; (2) 355,469; (3) 355,470. Railway Telegraphy; L. J. Phelps, New York, N. Y., Assignor to the Railway Telegraph Company. Applications filed July 3, 1886. These inventions contemplate the employment of an apparatus for communicating with the railway train by what is termed "vibration signals;" that is to say, signals whose elementary portions consist each of a series of electrical pulsations, vibrations or waves of any desired kind and of any desired rapidity. The vibrations may be all of the same polarity, or of successively opposite polarity. The inventions show various modes of accomplishing this object.

(1) 355,491; (2) 355,492; (3) 355,493. Cable Hangers; George L. Wiley, Brooklyn, N. Y. Applications filed June 19, 1886. These inventions all consist essentially in providing a suspension wire to which are attached hangers of substantially the form illustrated in the cut. The conducting cable or wire is held by the loops in the lower ends of the hangers. See illustration of one form.

355,548. Signal Box; A. Meyer, Baltimore, Md., Assignor to J. Frank Morrison, of same place. Application filed Oct.



355,492. CABLE HANGER.

20, 1886. In general terms, the invention consists in providing a circuit closing device with two operating mechanisms, one of which may be set in any one of several positions, and when released serves to send a corresponding number of impulses, while the other is constructed to transmit an arbitrary group or combination of impulses by actuating the circuit closing device each time the instrument is operated.

355,611. Coupling for Electric Wires; H. Howson, Philadelphia, Pa. Application filed Oct. 26, 1886. The ends of the wires are inclosed by a metallic sleeve, which also contains solder. When the parts are together, heat is applied to the sleeve and melts the inclosed solder, which, when cool, securely fastens the joint.

355,655. Ball Ornament for Lightning Rods; A. J. Munson, Indianapolis, Ind. Application filed June 18, 1886. A separate glass tube forms the means by which the ball is attached to the rod, while screw-caps and rubber washers serve to seal the joining of the glass tube with the ball and with the rod at the openings in the ball.

355,662, Printing Telegraph; S. E. Pike, New York, N. Y., Assignor of one-half to R. W. Pope, of Elizabeth, N. J. Application filed Feb. 25, 1886. The invention consists in adding to a printing telegraph instrument additional type wheels carried upon the same shaft and revolved by the same instrumentalities as heretofore employed. These additional wheels are provided with similar apparatus for printing from either type wheel at will, so that during the time that is necessarily lost in selecting the different transmitting keys and effecting impressions from one set of type wheels, one or more additional transmitters may be operated and impressions effected from the additional type wheels. Each printing device is included in an independent line, so that currents are sent to the different press magnets at the same or different times.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.